FUTURE CITY® COMPETITION

Program Handbook

2019–2020

www.futurecity.org

Each year 6th, 7th, and 8th grade students embark on a transformative experience as they explore how to make the world a better place. Working in teams, participants spend four months imagining, researching, designing, and building cities of the future.

DISCOVER

LET'S MAKE A DIFFERENCE

DISCOVER

LET'S MAKE A DIFFERENCE

What Does DiscoverE Do?

DiscoverE leads a growing volunteer movement that inspires and informs present and future generations to discover engineering. Each year, we host programs (like Future City) and create resources educators and volunteers can use to inspire future engineers.

DID YOU KNOW...

86% of educators and volunteers say that DiscoverE's programs and resources are essential to their ability to engage students in engineering.

Visit DiscoverE.org for:

CLASSROOM ACTIVITIES

Looking for more hands-on engineering activities to support your work? DiscoverE has over 125 educator-tested and approved activities.

Download the Levitating Train activity and challenge your students to build a levitating train that can balance on a magnetic track.

DISCOVER ENGINEERING

Full of information about engineering careers, this is the first place any student, educator or parent should go to learn more about engineering.

INTRODUCE A GIRL TO ENGINEERING DAY (FEBRUARY 20, 2020)

Invite a female engineer into your classroom or after-school club to talk to your girls (and boys) about how rewarding a career in engineering can be.

ENGINEERS WEEK (FEBRUARY 16–22, 2020)

Engineers Week is a time to celebrate how engineers make a difference in our world. It's a great time to do engineering activities, present engineering careers to your students, or bring your students to a public Engineers Week event at a local university or business.

Future City is a program of DiscoverE.

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Overview

What Is Future City?

Future City is a project-based learning program where students in 6th, 7th, and 8th grades imagine, research, design, and build cities of the future. Keeping the engineering design process and project management front and center, students work in teams to ask and answer an authentic, real-world question: How can we make the world a better place?

Future City started in 1992–1993 in just five cities and with 200 students. Today, 45,000 students around the globe learn how engineers make the world a better place.

Students involved in the Future City Competition spend approximately four months creating cities that could exist at least 100 years in the future. Each city must incorporate a solution to a design challenge that changes each year. This year's challenge, Clean Water: Tap Into Tomorrow, asks participants to identify a threat to their future city's water supply and design a resilient system to ensure a reliable supply of clean drinking water. In January, students will present their cities to judges at Regional Competitions throughout the United States, Canada, China, and Egypt. Teams that win their regional competition in the US receive airfare and hotel accommodations for five members of their team to attend the Finals held in Washington, DC, in February.

"The Handbook has everything you need. It's a real treasure. It can be overwhelming at first, so be kind to yourself. Sit down with a cup of tea and in a leisurely way flip through. Use sticky notes and mark what you think will be helpful for you."

–Carol Reese, Texas (North), Educator of 2017 Grand Champion team

The Future City Framework

Three strands form the framework of this project, each supporting and informing the others. The creation of the city via five competition deliverables is the main strand. The other two are the engineering design process and project management. This framework gives the project a real-world structure that both enriches the whole experience of Future City and extends the learning into the students' academic and professional futures.

Engineering Design

Future City introduces students to the engineering design process. This logical series of steps shows how engineers approach a problem. As students work through the process, they will realize they can think like engineers and see themselves as problem solvers. Once they get the hang of the engineering design process by using it to build their future city, students can apply it to all kinds of challenges.

Project Management

In engineering, the success of a project often hinges on proper management of the project goals. Project management is a professional organizing system that focuses on keeping projects and teams coordinated and moving forward. Future City uses a student version of the project management process. It dovetails well with the engineering design process, whose steps fit within the broader phases of project management.

Leading Your Team

ONLINE

Learn more about applying the engineering design process and project management methods to the competition at Leading Your Team (futurecity.org/leading-your-team).

What Educators Are Saying

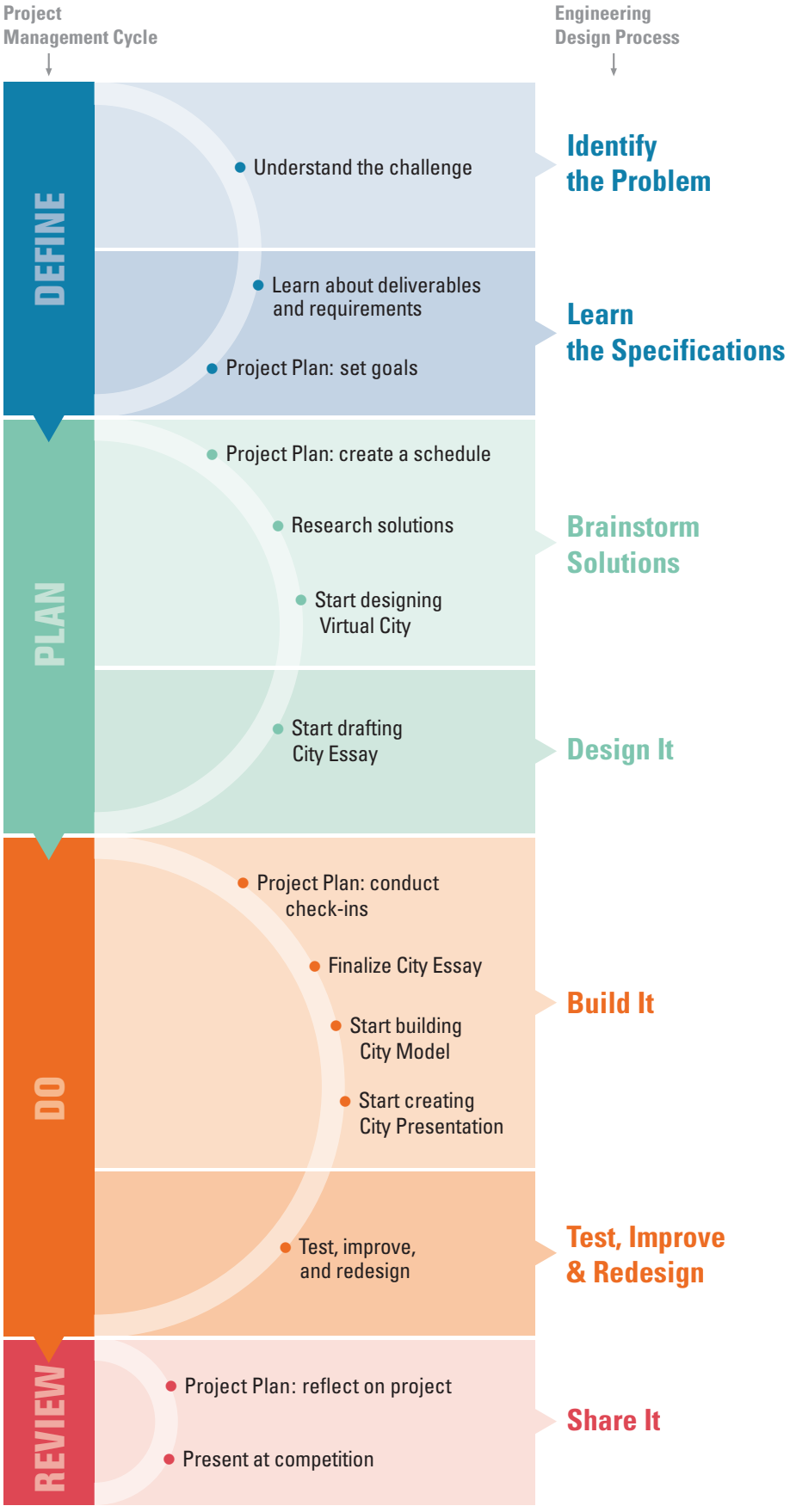
"The kids have experienced more "real world" learning through this project than anything else they've ever done in school before."

– Danielle Lotton-Barker, Great Plains Educator

"I now use the engineering design process in all of my lessons, regardless of whether I'm teaching Future City or not. It encourages creativity and emphasizes the importance of revising and trying again when things don't work out."

– Angela Conrad, Iowa Educator

Create Your Future City



ONLINE

Stages and Steps of Future City

This graphic shows the basic steps for guiding your team through the Future City Competition. Your team may move quickly through some steps and take extra time for others. You can share this graphic with your students by:

- Showing an animated version from Leading Your Team at futurecity.org.
- Downloading and displaying a colorful printout at futurecity.org/resources (filter for Handbook & Student Handouts) for students to refer to as they design their city.

How Does the Competition Work?

Future City is open to kids in grades 6, 7, and 8 who are from the same school, a home school environment, or are members of a nationally, regionally, or state-recognized youth-focused organization, such as the Boy or Girl Scouts, Boys and Girls Clubs, or 4-H. Not sure if your organization qualifies? Contact info@futurecity.org.

The Future City Competition consists of five project deliverables. Teams can earn up to 258 points.

About Due Dates:

Each region sets its own due dates. Check with your Regional Coordinator to find out what your region's due dates are. At the Regional Competition, scores from all of the deliverables are added together to determine the top team. The first place team in each US region advances to Finals held in Washington, DC (February 15–19, 2020).

PROJECT DELIVERABLE	COMPETITION POINTS	DUE DATE
1. PROJECT PLAN	**10 POINTS**	**DUE ONE WEEK BEFORE THE COMPETITION**
Students complete a Project Plan to help them plan and organize their work. They use it throughout the project.		
2. VIRTUAL CITY	**48 POINTS**	**DUE BEFORE COMPETITION**
Students design a Virtual City using SimCity software and present their city's progress via a slideshow presentation.		
3. CITY ESSAY	**60 POINTS**	**DUE BEFORE COMPETITION**
Students describe the unique attributes of their city and provide a solution to this year's challenge: Choose a threat to the city's water supply and design a resilient system to maintain a reliable supply of clean drinking water. (1,500 words maximum)		
4. CITY MODEL	**70 POINTS**	**PRESENTED AT THE COMPETITION**
Students build a physical model of a section of their city using recycled materials. In addition to showcasing their city of the future, the City Model must also show the team's solution to this year's challenge and include at least one moving part.		
5. CITY PRESENTATION	**70 POINTS**	**PRESENTED AT THE COMPETITION**
Students give a 7-minute presentation about their future city and their solution to the challenge, followed by a 5-8 minute question and answer period with the judges.		

ONLINE SUBMISSION PROCEDURES

All teams must submit their Virtual City, City Essay, and Project Plan via the online submission center at futurecity.org. Submission instructions are available from your Regional Coordinator or at futurecity.org/resources (filter for Competition Forms & Project Plan).

New to Future City?

One of the best things about Future City is how many curriculum connections you can make and all the different ways an educator can structure the program. Many first and second year educator participants tell us this can also be the most challenging aspect of the program.

To help you get started, we asked veteran Future City educators to share the one piece of information they wished someone had told them when they were new.

Read the whole handbook.

One of the biggest things I would say is to read the handbook carefully. It took me a few years of falling down to learn that lesson the hard way myself. So be sure that you read the handbook carefully, and if you have any questions, reach out to your Regional Coordinator.

– Travis Kopal, Justice Page Middle School, MN, 8 years in Future City

Ask your Regional Coordinator to connect you to a veteran teacher.

When I first started, my coordinator put me in touch with an awesome teacher with tons of Future City experience. My region even has workshops for new and returning educators – all of the veteran teachers have been amazingly helpful!

– Margo Gore, Kennedy Middle School, SC, 12 years in Future City

Go to the Regional Competition even if your team didn't complete all of the deliverables.

I love taking them to the competition, even when they're unprepared. They can learn so much.

– Kristine Miranda, Transit Middle School, NY, 15 years in Future City

Pick one or two deliverables and concentrate on them.

I always say you don't have to start big. Start small! Let the kids be creative, direct them towards research and you will be surprised. You have to be patient because it is a learning process for everybody.

– Eleonora Straub, St. Jude the Apostle Catholic School, GA, 8 years in Future City

Let the kids do the work.

I delegated the responsibility to the students and they do a lot of work on their own after school, on weekends, and I, you know, I give them the criteria for success and they just run with it, which has really been nice to see.

– Michael Gervis, Harding Township Middle School, NJ, 4 years in Future City

Find a mentor.

My mentor has been so helpful! They bring a different perspective to the whole project and the kids really love working with them. I found my mentor by asking around. It turns out the neighbor of a teacher I work with is an engineer and he volunteered! He was happy to take the time to give back to the community and pass along his interest in engineering.

– Karen Compton, The Ellis School, PA, 10 years in Future City

Can I Still Do Future City Without Competing?

Yes! Future City is first and foremost a Science, Technology, Engineering, Art, and Math (STEAM) program. Educators, parents, and mentors are encouraged to adapt Future City to match their particular goals. Over the years, educators and mentors have used the Virtual City to teach city planning, the City Essay to strengthen research and writing skills, and the City Model to understand scale and city planning.

Future City Aligns with Academic Standards

Go to futurecity.org/resources (filter for Standards) and download PDFs showcasing how Future City aligns with:

- Common Core State Standards
- Next Generation Science Standards
- Benchmarks for Science Literacy
- National Education Technology Standards
- Principles and Standards for School Mathematics
- Performance Indicators for Technology-Literate Students
- National Visual Art Standards

Future City Curriculum Connections & 21st-Century Skill Development

COMPETITION DELIVERABLES	Math	Science	Art	Research	Writing	Civics/ City Planning	Public Speaking	Engineering Design Process	Problem Solving	Teamwork	Project Management
PROJECT PLAN Complete plan to stay organized and focused throughout the project.					✔			✔	✔	✔	✔
VIRTUAL CITY Use SimCity software to experiment with city design and development.	✔			✔	✔	✔		✔	✔	✔	✔
CITY ESSAY Describe your city and solution to a citywide sustainability issue.	✔	✔		✔	✔	✔		✔	✔	✔	✔
CITY MODEL Build a scale model using recycled materials.	✔	✔	✔	✔		✔		✔	✔	✔	✔
CITY PRESENTATION Present your city to a panel of judges at your regional competition.			✔	✔	✔	✔	✔	✔	✔	✔	✔

Community and Impact

A recent evaluation conducted by Concord Evaluation Group found that Future City delivers on its educational promise.

Students Build 21st-Century Skills

Educators, mentors, and parents agree Future City strengthens students' skills.

	Educators	Mentors	Parents
Teamwork	94%	94%	94%
Problem Solving	90%	84%	92%
Public Speaking	89%	92%	85%
Writing & Research	85%	86%	78%
Time Management	80%	77%	81%

Students Learn Value of Math, Science, and More

- 85% now see math and science as important to their future.
- 57% said Future City helped them in their other classes.

Students Discover Engineering

- 83% reported they learned how to use engineering to solve real-world problems.
- 80% reported that Future City helped them learn the value of project planning.
- 68% said Future City helped them see themselves as engineers someday.
- 69% said Future City made them want to keep doing other engineering clubs or activities.

Student Confidence Soars

- 75% said Future City boosted their self-confidence.
- 85% said Future City taught them they could create something on their own—without the direction of an adult.
- 68% report Future City gave them a place where they fit in.

Students Learn How Their Communities Work

- 85% report that Future City helped them learn how cities work.
- 89% reported that Future City helped them appreciate all of the engineering that goes into a city.
- 73% reported they are more aware of civic issues like politics and taxes.

2019 Alumna of the Year

Cassandra Mitsinikos

Cassandra's Future City experience in 2014 ignited her fascination with engineering and her drive to make the world a better place. Today, she studies engineering at Johns Hopkins University and volunteers with Engineers Without Borders. She learned about renewable energy during Future City and wants to improve the efficiency and storage of these technologies for the benefit of future generations.

Share Your Experiences!

"Like" us on Facebook at www.facebook.com/FutureCityCompetition. You'll get tips and advice throughout the competition and be able to share your Future City experiences with other teams.

Share your experiences and pictures. Use the hashtag #FutureCity2020.

Want to see your team in next year's handbook or on FutureCity.org? Send pictures of your team working on their city to Info@FutureCity.org and they may be included next year.

Preparing for the Competition

Prepare to Lead: A To-Do List for the Educator

This checklist is a compilation of the preparatory tasks successful educators do in order to ensure a great Future City experience for all involved—their students and themselves. Check off each box until you've completed the list and you can be sure that you're ready to lead your team!

Getting Started

- ☐ **Read this handbook in its entirety.** It gives you a sense of the scope of the project, who you need to be in touch with, how to find key information, and what the steps are for students to complete the project.
- ☐ **Contact your Regional Coordinator** to find out what your regional deadlines are. See if there are any trainings or other ways to check in and get questions answered.
- ☐ **Register your school/organization** at futurecity.org/register by October 31, 2019.

REGISTRATION

It only costs $25.00 per organization to register. Participants who register will receive everything they need to successfully implement Future City, including:

- Program handbook
- Curriculum materials (activities, rubrics, worksheets)
- Competition forms and checklists
- SimCity software (up to two codes per registered educator)
- Support from your region, such as training sessions, email updates, and tip sheets
- Opportunity to compete at a Regional Competition

- ☐ **Complete the Home School Affidavit.** If you are a home school educator, you will need to complete the Home School Affidavit Form to verify that your home school is operating in accordance with the laws in your state. You can download the form at futurecity.org/resources (filter for Competition Forms & Project Plan).
- ☐ **Create a preliminary schedule** to guide your team through each step of the project, leaving time for contacting mentors and having them work with students as well as allowing wiggle room to meet the regional deadlines.
- ☐ **Contact parents** to see who can help with specific tasks.
- ☐ **Obtain SimCity codes.** You may request up to two codes. You will receive your codes automatically (after July 15, 2019) in the Online Team Center after completing the second step of registration, the Program Details Survey. Note: Additional codes may be requested by emailing info@futurecity.org. Extra codes are not guaranteed.
- ☐ **Meet with your IT department** about setting up SimCity and working out any problems with firewalls or other technological roadblocks.
- ☐ **Explore the Future City website carefully by visiting futurecity.org. Bookmark this site on your computer!** Take notes on what you want to remember or work on with your students. Spend some time in the resources section. It's where you can download everything in the handbook (and additional activities) and where you can solidify your understanding of the project.

- [ ] **Choose activities** from the Resources section of futurecity.org to introduce students to specific elements of the project, such as infrastructure and scale. This handbook tells you when students should complete an activity. Practicing with concepts and skills before they work on the project is really important so that students can apply what they've learned and exercise judgment and creativity rather than learning on the fly.
- [ ] **Download and copy competition forms;** make sure students complete and sign them. Forms (including the Media Waiver, Honor Statement, and Competition Expense Form) are available at futurecity.org/resources (filter for Competition Forms & Project Plan).
- [ ] **Visit the Gallery section of futurecity.org** to see models, essays, and presentations from previous years. It's a great way to understand what this competition is all about and what high scoring entries look like.
- [ ] **Gather supplies for the City Model.** Stockpile a wide variety of recyclable materials—art supplies, bits of household appliances, paper towel rolls, leftover paint, water bottles, and so on.
- [ ] **Make sufficient copies of student materials,** located in Appendix: Deliverables starting on page 40.
- [ ] **Organize your team.** Create the team format that works for you and your students. You may have a team of three students or a larger team that accommodates your needs and goals. As you decide what format works for you, review the Team Format Options.
- [ ] **Find a mentor.** Mentors can be engineers, technical professionals, architects, urban planners, city managers, or others who work in the engineering and technical community. Ask your students if their parents or relatives are engineers or technicians. Don't be shy—mentors who participated in a recent survey told us they volunteered because they were asked!
- [ ] **Download Tips for Working with Your Mentor** at futurecity.org/resources (filter for Handbook & Student Handouts).
- [ ] **Can't find a mentor?** Contact your Regional Coordinator. Find your Regional Coordinator's email address on page 95 or visit futurecity.org and click on Find My Region.
- [ ] **Establish a schedule** of when the mentor can work with the team.

Mentors Make a Difference

80% of students said the mentor was important in guiding them through the project, and 53% said the mentor helped them see themselves as an engineer someday!

"It was incredibly rewarding to see the students be creative. Instead of simply taking my suggestions as described, they made it their own."

– Anya Dela Cruz, California Mentor

The Website

Futurecity.org is your online destination for:

- **Activities and Background Information**—Use these resources to teach key concepts to your students.
- **Competition Forms**—Download writeable PDF versions of all the competition forms.
- **Gallery**—Get inspired as you view winning models, read City Essays from past winners, and watch student presentations.
- **Leading Your Team**—Learn how project management can help you successfully complete your future city.
- **Online Submission Center**—Upload your Virtual City, City Essay, Project Plan, and all competition forms via the website.
- **Rules & Rubrics**—Download the assessment rubrics and competition rules for reference throughout the competition.

There is a filter system in place in the Resources section that makes finding resources easier. You can sort by specific topics, such as SimCity, Competition Forms, Student Handouts, and Background Activities.

Team Format Options

1. OFFICIAL TEAM

The Official Team includes three student presenters, one educator, and one mentor. Most Future City Regions welcome teams that are larger than the three presenting students, however, only the three official students are allowed to present at the Regional and Finals Competitions. Check with your Regional Coordinator for more details.

2. MULTIPLE TEAMS

An organization is permitted to form multiple teams under the single $25.00 registration fee. If you decide to field multiple teams, please check with your Regional Coordinator about the number of teams an organization is allowed to bring to the Regional Competition. Note: Only the top scoring team from an organization is allowed to advance to the final round of the Regional Competition. See Competition Rule number nine on page 85 for more information.

3. OTHER TEAM FORMATS

Some classrooms or clubs choose to work together as one team, dividing the work into smaller working groups such as a research group or city model group. If you decide to work in this manner, you will need to select three students to serve as the "official presenters" at the Regional Competition.

Competition forms, including the Media Waiver, Honor Statement, Competition Expense Form, and Home School Affidavit can be downloaded at www.futurecity.org/resources (filter for Competition Forms & Project Plan).

Preparing Your Students

Students will get the most out of Future City if they first develop some familiarity with:

- Engineering and what engineers do
- The engineering design process
- Project management
- Cities: what they are and how they are put together and planned

Introduce Engineering

What do your students already know about engineers and the different kinds of engineering? Have a conversation to find out.

WHAT IS AN ENGINEER?

A lot of students don't know much about engineering. If this is true of your students, adapt this script to initiate a conversation about engineers.

✷ Engineers are changing the world all the time. They dream up creative, practical solutions and work with teams of smart, inspiring people to invent, design, and create things that matter.

✷ Can you name a few things that engineers have designed or built?

✷ Engineers protect the planet by developing state-of-the-art recycling systems. They design high-tech running shoes and develop life-saving medical technology.

✷ Engineers get to work in any field they want to. Do you love music? Engineers design new ways to record and listen to sounds. They also design technology so that deaf people can hear. Love cars? Engineers build better, more efficient engines that run on everything from corn husks to electricity.

Explore Engineering Fields

Have students do a quick search of the many careers and areas of focus within the engineering field. A good resource is the Discover Engineering section of the DiscoverE.org site. Some of their results should include aerospace, agricultural, bioengineering, biomedical, chemical, civil, computer, electrical, environmental, industrial, manufacturing, materials science, mechanical, nuclear, petroleum, and more!

Learn from Real Engineers

Work with your mentor to provide students with opportunities to learn more about engineering.

- Have students interview different types of engineers and share what they learn with their teammates.
- See engineers in action. Arrange a field trip to an engineer's office, power plant, water treatment center, local engineering college or university, and other engineering-related workplaces.
- Invite your mentor and other professionals to talk to the students about science, engineering, and technology careers.
- Share current news about projects your mentor or other engineers are working on.

Learn more about engineering at:

- DiscoverE.org/discover-engineering
- pbs.org/designsquad

Engineering Design Process

When engineers work to answer questions or solve problems, they use a specific approach: the engineering design process. It is a great way to work through any challenge that involves creating something that did not exist before or improving a process or product.

Explore the Engineering Design Process

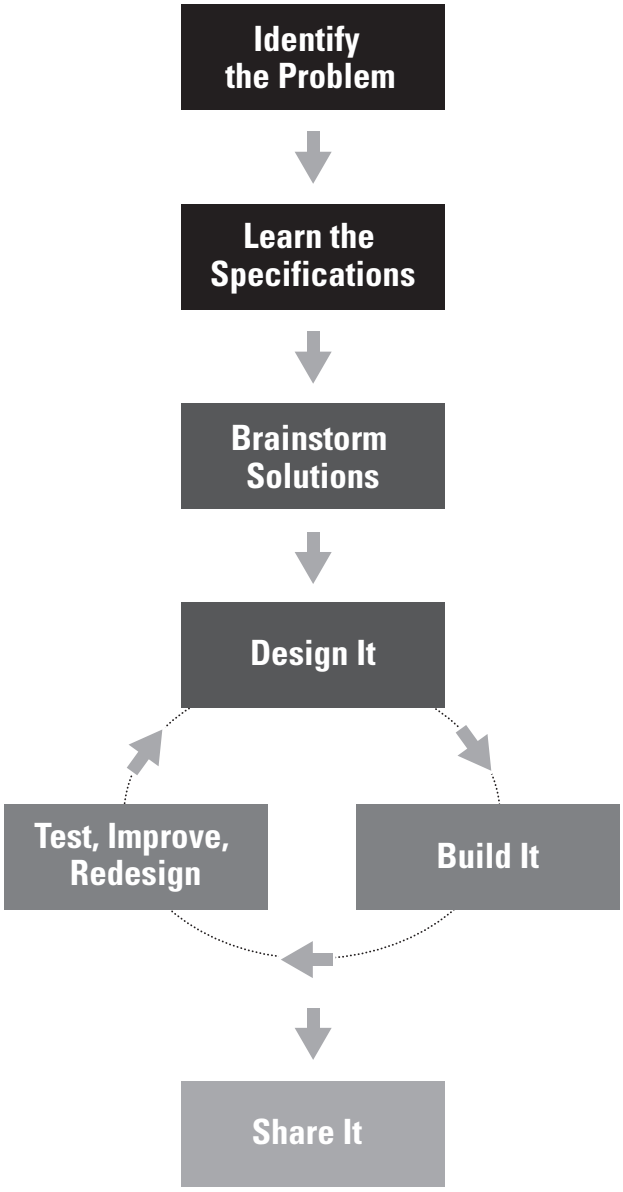
As kids learn about engineers through discussion, research, and interviews, introduce them to the engineering design process.

Show your students the engineering design process animation at futurecity.org/leading-your-team. Have copies of "The Engineering Design Process" graphic on hand so you can review it and discuss the various stages. Point out that engineers don't follow the engineering design process as if it's a list, with one step followed by another. Instead, it's cyclical: they may begin at one step and move back and forth between steps numerous times. Download the graphic at futurecity.org/resources (filter for Handbook & Student Handouts).

PRACTICE USING THE ENGINEERING DESIGN PROCESS

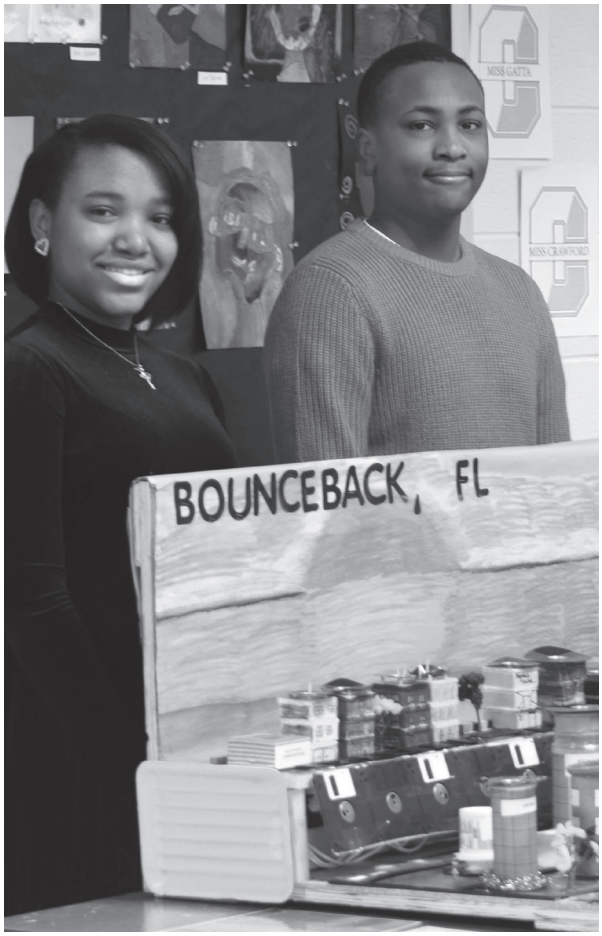
Students can practice applying the engineering design process with:

- Tower Building Activity (at futurecity.org/resources filter for Activities & Background)
- Cargo Bridge Game (coolmath-games.com/0-cargo-bridge-2/index.html)



ENGINEERING DESIGN PROCESS

Display a colorful version of this graphic for students to refer to as they design their city. Download at futurecity.org/resources (filter for Handbook & Student Handouts).



Engineering and Teamwork

Teamwork is essential to the engineering design process. Engineers have to be able to communicate accurately and work well with colleagues and clients in order to be effective members of a team. Frequently, the combined ideas of the team lead to the best solutions!

The Tower Building activity (referenced on the previous page) also allows you to introduce the teamwork element of the engineering design process. After you've completed the activity, ask: How easy was it to work together? Was there conflict in their group? How did they resolve it?

We have more resources on teambuilding. Go to futurecity.org/resources (filter for Activities & Background Info) for information and activities related to teambuilding.

WATCH MARSHMALLOW CHALLENGE VIDEO

Share the following TED talk with students. In this video, Peter Skillman shares his research after conducting more than 70 Marshmallow Challenges with a variety of participants ranging from lawyers to recent business school graduates. His findings include the importance of prototyping and that having a team with diverse skill sets really matters. He also shares some of the reasons why engineers, architects, and kindergarten students are able to create the tallest, most stable structures!

ONLINE

Marshmallow Challenge video:
www.youtube.com/watch?v=1p5sBzMtB3Q

"I love that Future City asks students to use project management, especially because it isn't something we usually teach. Recently a student told me, 'Oh, you know after Future City, my National History Day project was so much easier because I laid out my deadlines, I figured out what I needed to do, I made a schedule, and I set my goals. It wasn't nearly as stressful.'"

– Kate Baten, Florida (Tampa Bay) Future City Educator

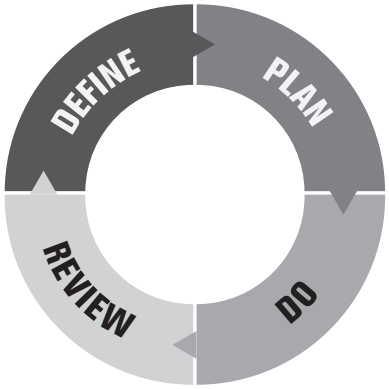
Project Management

In engineering, the success of a project often hinges on proper management of the goals, budget, timeline, and resources. As engineers work to solve problems they incorporate specific project management methods into the engineering design process.

To help students learn this process, the Future City Competition uses a student version of the project management cycle. This version differs slightly from the more detailed project management cycle used by professional project mangers and serves as a wonderful introduction to project management.

Project Management Cycle

(Student Version)



Project Management Cycle

(Professional Version)

As you introduce students to the project management cycle stages, remember that the time spent in each of the stages differs for educators and students.

ABOUT PROJECT MANAGEMENT

SCRIPT

Project Management may be a more familiar concept to students than the engineering design process. Deepen students' understanding by adapting this script to fit your needs.

✷ We all manage projects—students, parents, educators, everybody. Planting a garden, remodeling a kitchen, pulling together a year's worth of lesson plans—projects are how we get important things done. Engineers manage them too. Project management is a short way of saying all the stuff that we have to do to get from the beginning to the end of a project, like knowing what we want to accomplish, what we'll need in order to accomplish it, who needs to do what to get there, and by when. The more complicated the project, the more management it takes!

✷ There are four main stages of project management: Define, Plan, Do, and Review. If you know what you need to do in each stage, your project will go more smoothly. Engineers rely on project management because without a system, their projects can go over budget, take too long, or not meet goals. They also might get really confusing. Using project management as you build your future city will show you how useful it is.

ONLINE

Two resources you can use to introduce project management to your students are:

- A project management cycle animation at futurecity.org/leading-your-team.
- The Lego Structures activity at futurecity.org/resources (filter for Activities & Background).

THE STAGES OF PROJECT MANAGEMENT

SCRIPT

Adapt this script to review the four stages of the project management cycle. As you discuss each stage, ask students if they can give any examples from projects they've worked on.

✷ In the **Define stage** of project management, we think about what the project consists of. We get a good understanding of the requirements. We learn what the goals are, what the budget is, and the due date. We gather all of the pertinent information about the project.

✷ In the **Plan stage** we create a schedule, assign roles, and decide what materials we need. The Plan stage is critical to the success of the project. The better a project is planned, the more likely it is to go smoothly! For Future City, your Project Plan is a handy place to write down this information. You will probably have to change things as you go and fill in some things later. Plans need to stay flexible but at the same time help you make your deadline.

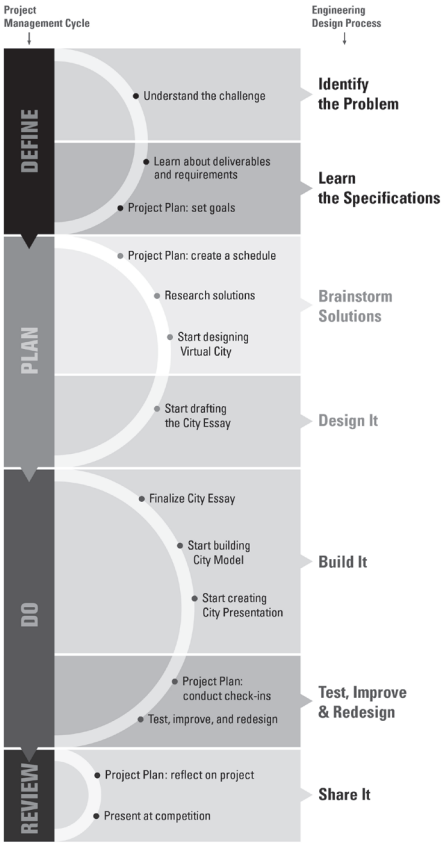
✷ The **Do stage** is where you actually work on the project. It's where you build, create, fix—whatever the project needs. You have to stay in good communication with your teammates as you accomplish each step. You also keep track of your progress by checking in with each other.

✷ The **Review stage** happens once the project is complete. Now is when you share your results, reflect on what you've learned, and celebrate.

How the Processes Work Together

Putting these two processes together is a win-win—the engineering design process helps students design their solution to the Future City Competition, and the project management cycle provides the approach they need to get it done.

Each step of the engineering design process aligns with a different stage of the project management cycle. The Future City Competition follows the stages of both processes, serving as a framework to guide students through the competition.



"Future City was challenging but I loved it. I learned so much about cities, engineering, and problems in the real world."

– Student Participant

Your Coaching Role

In the Future City Competition, educators and mentors act as learning coaches. The work itself must be student-led, from the initial brainstorming to their ideas and work.

Remind students that you are always available to guide, support, and inspire them. Your role is to facilitate and guide the process, but the project and the deliverables must be the work of the students.

Learn About Cities

In order to create cities of the future, students need to understand what a city is. What makes a city a city? What are its underpinnings? Who designs, builds, and maintains cities?

Build students' background knowledge before they start their Future City projects so that they can approach the work like professional engineers, with an informed perspective.

Defining a City

First things first: What, exactly, is a city? Work with your students to come up with an informal working definition of a city. Write down their first thoughts on the board.

WHAT IS A CITY?

SCRIPT

Get students' thinking more deeply about what cities really are by adapting this script to fit your style and needs.

✷ Some people think that a city is a place where a lot of people live and work. Others think that it's a town—which can also be described as a place where a lot of people live and work—only a city is bigger, with more people. You could say that a city is everything inside the border of a particular city's government. Everyone inside that border votes on what happens in their city. But a lot of times the city has outgrown those borders, or there is just as much urban area surrounding those borders. If you had to say how many people lived in Mumbai, how would you decide where that massive city begins and ends?

✷ Up until about 150 years ago in England, no matter how big your town was, you couldn't call it a city unless it had a cathedral. England had a lot of enormous towns, with no cathedrals, and tiny cities that did have one. These days England can't decide exactly how to define a city. They're not the only ones! Urban planners, the people whose job is to improve cities, don't have one unified definition of a city either.

✷ And yet, most people agree on certain features that something called a city has to have. Let's do some research to see how we think we'd define a city.

ONLINE

VIDEO: HOW CITIES CHANGE?

To highlight the concept of how cities change over time, compare the differences between cities 100 years in the past and cities of today. You can show students the 4-minute video *Urbanization and the Future of Cities* (youtube.com/watch?v=fKnAJCSGSdk), which illustrates how cities developed and ways cities of the future will need to adapt to growing population.

ONLINE

You can also have students do the What Is a City? activity at futurecity.org/resources (filter for Activities & Background Info).

City Features and Infrastructure

Ask students to look at their working definition of the term "city" and apply it to the city where they live (or the one nearest to where they live). Does it fit? Would they tweak their definition, now that they're thinking about it from the perspective of a city they know?

Next ask students this question: If you had to describe your city to a stranger, what would you say about it? How is it different from other cities? What do you like about it, and what do you not like?

After hearing from several students, note that they've just been talking about a city's features. Features are anything from parks to schools, shopping centers to freeways, neighborhoods to financial districts.

Explain that a lot of thought goes into the placement of specific city features. People who design and plan cities use certain terms to describe the way cities are organized. One of the most important terms for students to understand and use in this project is "infrastructure."

"Infrastructure" can be a hard word to grasp because it's about parts of a city that most kids don't think about or even notice.

INFRASTRUCTURE

Adapt this script to lead a discussion about infrastructure.

✷ "Infrastructure" is a term for the structures, systems, and facilities that make a city inhabitable—that is, a place that has what people need in order to live there. Examples of systems include sewage systems, electrical systems, and transportation systems. Examples of structures include bridges, roads, and government buildings. Examples of facilities include hospitals and schools. You can see why it's a very important term when we're talking about cities, even though it's a hard term to pin down!

✷ Tell students that their future city's infrastructure will be a very important part of their project. The more they understand about infrastructure, the better.

A great way to help students wrap their heads around infrastructure is to go on a scavenger hunt. Download the Infrastructure Scavenger Hunt Activity at futurecity.org/resources (filter for Activities & Background).

WHO DESIGNS INFRASTRUCTURE?

Engineers and architects design most of a city's infrastructure. For instance, civil engineers design water and waste systems, electrical engineers design lighting systems, and systems engineers design telecommunication systems. What other types of engineers do you think support a city's infrastructure?

Zoning

Tell students that another important element of city planning is zoning. Zoning refers to the way in which land in a city gets divided up and categorized. Zoning regulations and laws help ensure that a city can grow and change in a manageable, safe, and attractive way.

ZONING

The following script is designed to help you explain the different zoning categories. Before you begin, write on the board: residential, commercial, agricultural, industrial, and mixed use. As you go along, stop and ask students for examples of what they'd expect to find in a particular zone.

✷ City planners work with city officials, engineers, architects, lawyers, and developers to create specific zones for how land will be used within a city. Zones usually fall into one of the following categories:

- A residential zone is where people live. It can be high density, meaning that a lot of people can live in an area, usually in apartment buildings. Or it can be low density, which is usually single-family houses.
- A commercial zone is for stores and restaurants.
- Industrial zones are where factories and power plants are located.
- Agricultural zones feature farms and ranches.
- Mixed use means a blend of zones. City developers sometimes use the same area for residential and commercial zone. An example of mixed use is where you can leave your apartment and have a café, movie theater, clothing store, and grocery store right on your own block.

Have students explore zoning by creating city layouts in the City Zoning activity at futurecity.org/resources (filter for Activities & Background Info).

To dig deeper into zoning, consider the following:

- Show students a zoning map of their city and identify different zones. (Research the city name plus "zoning map" online to find a map of your city or one nearby.)
- Have students research the zoning designation for their home address, school, or other local businesses. Many cities have websites that allow individuals to input a specific address and receive information on the property, which includes its zoning designation. What are some of the different zones? What areas in their own city are considered industrial, commercial, mixed, and/or residential zones?
- Invite guest speakers from your local city planning department to show zoning maps and explain how cities are typically zoned.

City Planning

Tell students that zoning is one aspect of planning a city, but there are many others. City planning requires an understanding of all the systems and features that make up a city. City planners are always thinking about how to improve the quality of life in a city by fixing problems and planning how the city can grow and change.

Tell your students that they now have a good amount of background knowledge that they will call upon as they begin researching their future city. But they've only scratched the surface of the amazing world of city planning!

ONLINE

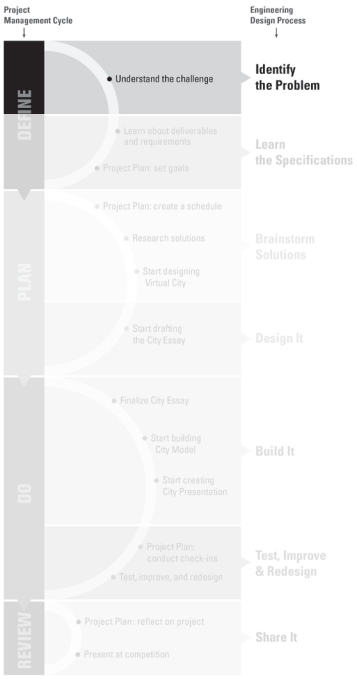
EXPLORE FURTHER:
CITY PLANNING

Visit futurecity.org/resources (filter for Activities & Background Info) and continue exploring city features and the process of city planning:

- City Planning Background Information
- City Planning Key Terms & Concepts
- Brainstorming and Ranking City Features: Explore how infrastructure helps get goods and services to where they are needed.
- People Who Create and Sustain Cities: Learn about the many professionals involved in designing cities.
- City Planning Word Investigation: Research definitions for common city planning words.
- Zones and Interconnectivity: Make basic urban plans for an imaginary city.
- City Planning Game: Learn how to design the placement of city elements within zoning areas.

DEFINE

Identify the Problem



During this first stage of the engineering design process—Identify the Problem—students establish an initial understanding of the scope of the challenge. This stage aligns with the first stage of the project management cycle, known as the Define stage.

Getting Started

Tell students that they are officially prepared to take on the Future City Challenge. They understand:

- what engineers do;
- the engineering design process;
- the project management cycle;
- what cities are, including infrastructure and zoning; and,
- the roles of professionals who plan and build cities.

They've formed their teams. They are ready to start!

On the Create Your Future City graphic, point to the very first bullet: Understand the challenge. Ask students what phase of the project management cycle they are in and then what step of the engineering design process they are in. These questions orient students to how the two systems work together.

ONLINE

Download the graphic at futurecity.org/resources (filter for Handbook & Student handouts).

THE FUTURE CITY CHALLENGE

Introduce Future City by adapting this script to fit your style.

✷ Every year, middle school students dream up cities that could exist at least 100 years from now. They design their cities in response to the question: How can we make the world a better place?

✷ You will create a city at least 100 years in the future. Your particular challenge is to choose a threat to your city's water supply and design a resilient system to maintain a reliable supply of clean drinking water.

✷ First you'll research cities. For example, you'll explore transportation systems, dig deeper into infrastructure and zoning, and more. You'll also research water supply systems and how engineers are designing resilient cities today.You'll learn more about city design with SimCity. With your team, you'll envision your own city of the future. You'll describe this city in detail in an essay. You'll build a three-dimensional model of it. And you'll present your city at the competition.

✷ Who will work with you on this project? Your team members, me (the educator), and our mentor. [Give kids the name and some background on your mentor, or have your mentor introduce him or herself, if present.]

✷ What do you have to make for this project? These are called deliverables, or the things you have to produce that will be judged for the competition. Deliverables are like assignments that you hand in. For this project there are five deliverables:

- **A Project Plan**—you will create a Project Plan to help you plan and organize your project.
- **A Virtual City**—you will design a city using SimCity software and present your city's progress via a slideshow presentation.
- **A City Essay**—you will describe the unique attributes of your city and the details of your innovative and resilient water supply system.
- **A City Model**—you will build a scale model of your city using recycled materials and incorporating at least one moving part.
- **A City Presentation**—you will present your city to a panel of judges at the regional competition.

Know, Want to Know, Learned

The kids may have a lot of questions at this point. You can help them organize their thoughts by asking the team to make a chart with three columns: Know, Want to Know, Learned. (You may recognize this as the classic K-W-L chart.)

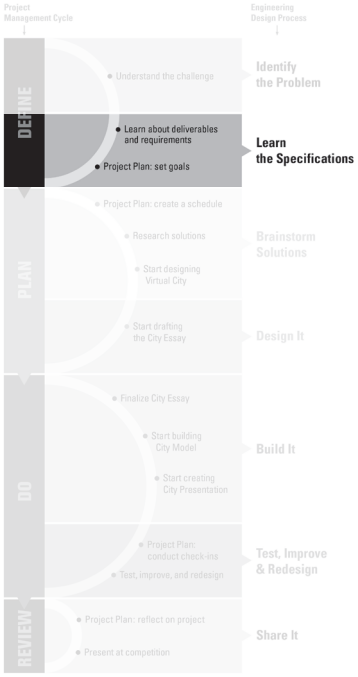
Know	Want to Know	Learned
EXAMPLE: Water needs to be cleaned before people can drink it.	How does water get cleaned?	Water may need to be filtered several times before it is safe to drink.

Ask the kids to write down everything they know about the project in the first column; this will help them retain what you just told them and what they've learned about cities. Then have them write down every single question they can think of. Once it looks as if the team has lots of questions, hold a discussion in which some of the questions are answered. Tell kids to write down any answers in the third column, across from the question.

Many of their questions will be answered in the very next phase of the engineering design process: Learn the Specs. Tell kids to keep their charts handy so they can keep filling in answers to questions (and thinking up more).

DEFINE

Learn the Specs



In the Learn the Specs stage of the engineering design process, students carefully review the competition requirements and learn about the specific characteristics that each deliverable must meet. They'll also identify resources, constraints, assumptions, and goals as part of their Project Plan.

Future City Deliverables

The following five items are all required deliverables of the Future City Competition for teams who are competing officially (detailed information about all of the deliverables can be found in Appendix: Deliverables starting on page 41).

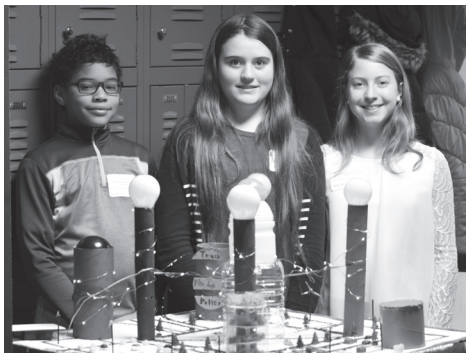
Deliverable 1: Project Plan

Made up of four parts, the Project Plan will help students stay organized, focused, and on schedule as they complete their other Future City project deliverables. The four parts are:

- **Part 1: Set Goals**
  - Completed during the Define: Learn the Specs stage, students describe what they hope to achieve by the end of the project.
- **Part 2: Create a Schedule**
  - Completed during the Plan: Design It stage, students plan how they'll complete each deliverable.
- **Part 3: Conduct Check-Ins**
  - Completed during the Do: Build It & Test, Improve, Redesign stage, students monitor their project's progress to keep on schedule, meet their goals, and see where the plan needs tweaking.
- **Part 4: Reflect on the Project**
  - Completed in the Review: Share it stage, students reflect on what they did and how they did it.

Unlike the other Future City deliverables, there is no rubric for the Project Plan. Teams that complete and submit all four parts receive ten points. Teams that submit an incomplete plan may receive five points. Teams that do not submit a plan will receive zero points.

Further instructions and four easy to complete project plan templates can be found in the Appendix: Deliverables starting on page 41.



Deliverable 2: Virtual City

Completed in the Plan: Brainstorm stage, students design a Virtual City using SimCity software. They begin by choosing two goals they want to achieve in their virtual city (e.g., developing a fully green city, designing a city that is a safe place to live and work, etc.).

At two points during the development of their SimCity, students will:

- document their city's development;
- assess their progress toward meeting their stated goals; and,
- share the strategies they are using to achieve their goals.

Students will insert their city's details in the Virtual City Presentation Template. This deliverable is worth 48 points and is due before the competition. Further instructions, a list of online resources, and the rubric can be found in the Appendix: Deliverables starting on page 51.

Deliverable 3: City Essay

Begun in the Plan: Design It stage, students write a 1,500-word essay that describes the unique attributes of their city and provides a solution to this year's challenge—Clean Water: Tap Into Tomorrow.

Students' challenge: Choose a threat to your city's water supply and design a resilient system to maintain a reliable supply of clean drinking water.

This deliverable is worth 60 points and is due before the competition. Further instructions, student handouts, and the rubric can be found in the Appendix: Deliverables starting on page 57.

IT'S NOT A STRAIGHT LINE

Although each deliverable is designed to stand on its own, students may find that they are working on them concurrently and will quickly realize that each deliverable informs the other in critical ways. For example, once they start experimenting with city design in SimCity they may want to refine how they are describing their city in the City Essay.

Deliverable 4: City Model

Begun in the Do: Build It stage, students build a physical model of their city. In addition to showcasing their city of the future, the City Model must also show the solution to this year's challenge.

The model:

- should be made primarily out of recycled materials;
- must have at least one moving part;
- needs to be built to scale; and,
- may not exceed the $100 expense budget.

This deliverable is worth 70 points and is presented at competition. Further instructions, student handouts, and the rubric can be found in the Appendix: Deliverables starting on page 71.

Deliverable 5: City Presentation

Completed in the Review: Share It stage, students present their future city, solution to this year's challenge, and model to a panel of judges at competition. The seven-minute presentation is followed by a question and answer period of 5–8 minutes with the judges. (Check with your Regional Coordinator for exact competition time limits.) Many regional competitions also provide the opportunity for teams to give brief presentations to additional judges to earn special awards.

Presentations are made by the three presenting students and includes the model and may also include:

- Display boards
- One handout or one brochure
- Costumes

Costs of the presentation materials must be included in the maximum $100 budget. This deliverable is worth 70 points and is presented at competition. Further instructions and the rubric can be found in the Appendix: Deliverables starting on page 78.

Project Plan: Set Goals

Setting project goals occurs in the Define phase of the project management cycle. Students deciding what they hope to achieve is also the first step of their Project Plan. As part of goal setting, students also think about any project constraints, what resources are available to them, and any assumptions they may have.

Hand out **Part 1 of the Project Plan** located on page 43 and at futurecity.org/resources (filter for Competition Forms & Project Plan). Tell students that the first team goal is the same for everybody and is already listed:

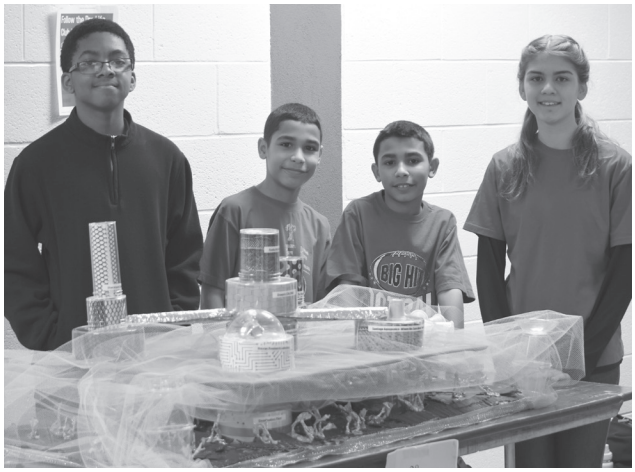
- Our team will successfully create a resilient water supply system for our future city.

Before they start creating more goals, have them start to identify available resources, constraints, and assumptions. The Project Plan template has useful explanations of these terms as well as questions to get the kids thinking. Let students know that thinking about what they want to do before they do it is critical to their success!

Now it's time to guide your team to think up several more goals. Explain that their goals are what they plan to achieve by the end of the Future City Competition. They can be about their city, like the goal above. And they can be about their team, how they will work together, and how they will handle the project itself. For example, "stick to the deadlines we set" or "work well together as a team" can be goals.

ONLINE

Learn more about goal setting and project management in the Leading Your Team section of futurecity.org.



What people are saying about Project Management:

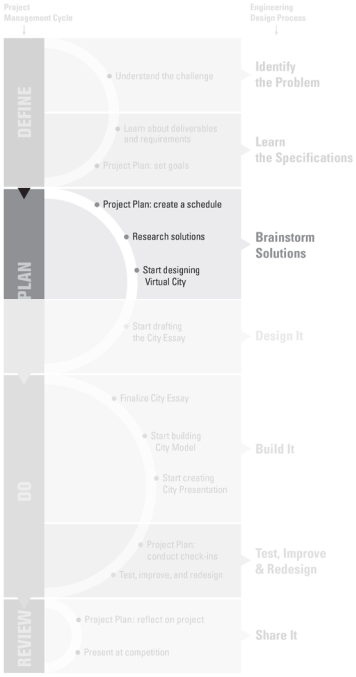
"We created an awesome city because we took the time to think about our goals and come up with a clear plan."

– **Student Participant**

"Knowing how to approach a problem and solve it using a project management strategy are skills these students will use throughout their professional careers."

– **Katherine Dewey, Future City Team Mentor**

Brainstorm Solutions



During the Brainstorm Solutions stage of the engineering design process, students use their Project Plan to schedule how they'll complete each deliverable. Then they steep themselves in research, create their Virtual City, and brainstorm various solutions to the Clean Water: Tap Into Tomorrow challenge and their overall city design. Project managers refer to this second stage of the project cycle as the Plan stage.

Project Plan: Create a Schedule

Explain to students that since they now have a better understanding of the project, it's time to start making a schedule and identify what needs to be done, by whom, and in what order. The schedule will help them keep track of time and the tasks they must do to successfully complete their deliverables.

Creating Schedules

There are many ways to make a schedule. Create a schedule using the process outlined below or let your students come up with their own.

Sample Process: On index cards or sticky notes, write down the tasks required to complete each deliverable. Color code them so that every task related to a particular deliverable is easy to see. The great thing about cards is they can easily be moved as the project and timeline evolves.

If you are using a bulletin board for index cards or a whiteboard or wall for sticky notes, you can make a master schedule by forming columns of tasks for each deliverable. Then you can superimpose a timeframe to see which tasks for which deliverables can happen at the same time, or which ones actually depend on something else getting done first. Finally, team members can decide who is in charge of which tasks.

If a task winds up taking longer than the teams thought it would, they can move that sticky note or index card to a later spot in the schedule. They can also mark completed tasks with big X's or another symbol so they can clearly see what tasks remain.

The most important thing is for the students to use a process that works best for them.

Research Solutions

Before students begin their research, it's a good idea to review everything they've learned to date and reorient themselves to their mission of creating a city that exists at least 100 years in the future.

STARTING YOUR RESEARCH

SCRIPT

Adapt this script to launch your team's research. The handouts mentioned below can be found starting on page 59 or downloaded at futurecity.org/resources (filter for Program Handbook & Student Handouts).

A fun part of Future City is dreaming up where our city is located, who lives there, where they work, and how they get around. We'll even create our city's history and culture. But before we do that, we need to understand cities of today and research topics like:

- housing options
- transportation systems
- utilities (like water, sewer, waste management, and internet)
- pollution controls, and
- social services (like education, health care, and fire/police protection)

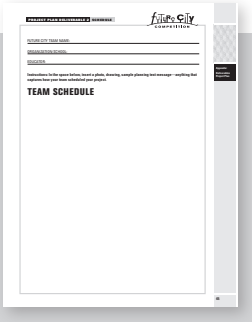
Let's look at the **City Design: Questions to Consider student handout.** These questions are designed not only to help us think of practical and innovative ideas for creating a resilient water supply system, but also to think about our city from all angles. The questions on this sheet are only starting points. As we do our research and learn more about cities, we'll want to add our own questions to the list.

We'll also need to start researching this year's topic—Clean Water: Tap Into Tomorrow. Let's look at the **Clean Water: Tap Into Tomorrow Overview and Research Questions student handout** and the **Clean Water: Tap Into Tomorrow Real-World Case Studies student handout.** Again, the information and questions are only starting points. We'll need to add our own as we work.

ONLINE

Suggested websites and books related to this year's theme are available at www.futurecity.org/resources (filter for Research Resources & Websites)

PROJECT PLAN DELIVERABLE


Future City COMPETITION

TEAM SCHEDULE

Students must submit **Part 2: Create a Schedule** as part of their Project Plan deliverable. Students can submit a photo of their schedule, a drawing, sample planning text messages—anything that captures how they planned their project. Find the Schedule template on page 45 or download at futurecity.org/resources (filter for Competition Forms & Project Plan).

ONLINE

For more tips on creating schedules, visit the Plan section of Leading Your Team at futurecity.org.

Research Tips

- **Use the Research Cards** as a way for students to document and organize the information and relevant sources that they find. Download and print copies of the Research Cards for teams, as needed, at futurecity.org/resources (filter for Research Resources & Websites).
- **Create an electronic project archive.** The project archive could contain file folders that can hold information produced and collected throughout the project. Basic folders could be titled: Project Plan, Expense Information, Research, Virtual City, City Essay, City Model, City Presentation. The project archive should be accessible to all team members.
- **Refer to the Research Strategies** document at futurecity.org/resources (filter for Activities & Background Information) for more research strategies and information on citing sources.

Design a Virtual City

Engineers often use simulation tools, like SimCity, to test different designs to determine which solution works best. The competition's Virtual City deliverable gives students the chance to try out their city planning ideas and explore various city development strategies using SimCity. Remind kids that they aren't designing their future city using this tool: its purpose is to see what the possibilities are. Then they will have a better sense of what could work well when it is time to design their future city.

Share with your students that designing a Virtual City is another form of research that gives them practice designing a city. This step will help them pull together what they've learned and prepare them for brainstorming solutions for their own future city.

ENGAGING THE WHOLE TEAM

If only one or two students are developing the Virtual City, you can still engage the whole team in selecting the city goals and brainstorming various development strategies to test. At each reporting stage, the Virtual City team leader(s) can present the city's current status so the full team can see how the strategies are working and then together they can make any adjustments.

Virtual City Resources

Future City has developed resources to help students create their Virtual City. Below are a few highlights. Find them and more in Appendix: Deliverables starting on page 51, or download them at futurecity.org/resources (filter for SimCity).

- **The Virtual City Requirements:** Make sure students are familiar with the requirements.
- **Sample Virtual City Presentation:** This will give students a great understanding of what is expected.
- **Virtual City Presentation Template:** Enter your screen shots, goals, and strategies directly to this template.
- **Virtual City Rubric:** Learn what the judges will be assessing.

STAYING ON SCHEDULE

The Virtual City is the first deliverable submitted for judging. Have you checked with your Regional Coordinator about when the Virtual City is due?

Brainstorm Solutions

Using what they learned from their research and from developing their Virtual City, it's time for students to begin brainstorming what their future city will look like. Now is the time to encourage creativity, problem solving, and futuristic thinking. Remind students that their city will exist at least 100 years from now.

Students can revisit what they came up with in the student handout **City Design: Questions to Consider** (see page 59). Discussing these questions and their research with teammates can yield lots of new ideas.

It is also time for the students to choose a threat to their future city's water supply. They must decide how they can ensure a reliable supply of clean drinking water for their city and its residents. Although the main focus is water supply, teams should also think about two other ways to show that their city is resilient. The team might want to measure their ideas against the rubrics. How well they match up could help students select the best solutions.

Choose Solutions Before Designing City

Before students move into the Design It stage, they should have a solid idea of the resilient water supply system they want to design that addresses the threat or stressor they chose.

Check the Schedule

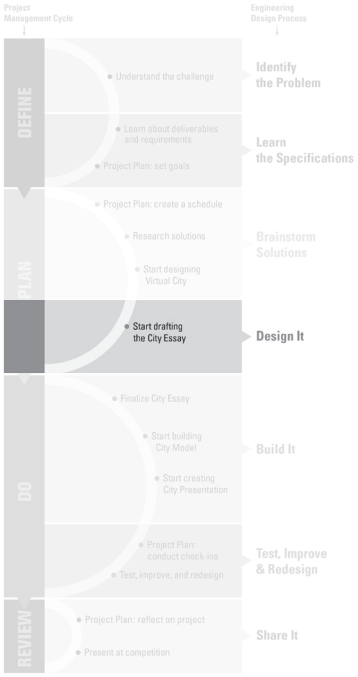
Teams will probably need to make some changes to their project schedule, now that they have decided on their water supply threat and resilient solutions. Give students time to add tasks, move them around, and make sure everybody is sharing the workload.

TEAMBUILDING BOOSTERS

If you find that students could use a teambuilding booster, refer to the Teambuilding document at futurecity.org/resources (filter for Activities & Background Info).

Design It

This stage of the engineering design process is where ideas take shape and visions grow. Students draw from their research and brainstorming to plan how they will create their resilient water supply system. Encourage students to ask their mentor for feedback on their chosen design. Their mentor may have expertise in this area or be able to call upon other colleagues to help evaluate the students' designs.



Draft the City Essay

The City Essay is the first place where students share their vision of their future city. Here they will answer the question: What makes your city special, futuristic, and innovative? They will also describe their solutions to the Clean Water: Tap Into Tomorrow challenge. Drafting their essay helps students synthesize their research, finalize key elements of their future city, and reflect upon their resilient, clean water supply solutions.

The City Essay and the team's research lay the groundwork for building the City Model and preparing the City Presentation. Students will refer to their research and their essay frequently in order to build the model of their future city and decide what to say in their presentation. This is an example of how the engineering design process works: what they accomplish in one stage informs what happens next.

Remember, the essay is due before the Regional Competition. Make sure you have checked with your Regional Coordinator for the exact due date.

TEST IDEAS WITH PROTOTYPES

A draft is kind of like a prototype: it's the version in which you work out the kinks. The draft of the City Essay is the prototype that helps students evaluate ideas, plan resources, and anticipate possible roadblocks before they create their final version of both the City Essay and the model of their city.

Suggested City Essay Outline

Most middle school students have had practice creating outlines before they write rough drafts of essays. But it never hurts to go over the basics.

HOW TO WRITE YOUR CITY ESSAY OUTLINE

Tell your students to ask questions and take notes as you review the competition's suggested essay outline and discuss how they can use it to draft their essay.

✷ **Part 1: The Introduction**

Briefly introduce your future city by including the basic city information. Include the city's name, how old it is, where it is, and how many people live there.

✷ **Part 2: A Closer Look**

Paint a picture of life in your future city, as if you are describing it to someone who has never been there. Share details about:

- The climate and natural features (like rivers, mountains, or a nearby ocean)
- What makes your city appealing to different ages and interests of people?
- The services your city provides (schools, hospitals, fire stations, public transportation)
- What are two examples of your city's resilience? (Be innovative! What's resilient about your city's housing? Transportation? Healthcare?)
- Any innovative or futuristic aspects of your city's infrastructure (such as housing, transportation, energy, pollution control, etc.)

✷ **Part 3: Define the Problem**

Describe the threat to your future city's drinking water that your team chose to focus on. Include:

- Describe the threat you chose
- Discuss the immediate challenges that this threat creates and any potential lasting effects on your city and residents
- Explain how the drinking water supply system is likely to be disrupted by this threat. What are the system's vulnerabilities?
- Evaluate the impact to the health and safety of the people in your city, including vulnerable populations (e.g., elderly, young, and/or economically-disadvantaged)

SCRIPT CONTINUED

✷ **Part 4: Describe Your Solutions**

Here's where you get to describe the innovative design of your future city's water supply system and how you've prepared it to be resilient from your selected threat or stressor. Be sure to:

- Describe your city's water supply system. Be sure to highlight which aspects are futuristic and innovative, and include water collection, storage, treatment, transport, monitoring, and demands.
- Describe two innovative ways you have prepared your water supply system to withstand your selected threat. Include how these solutions ensure the health and safety of city residents.
- Describe some of the risks connected with using the solutions and how the solutions reduce these risks.
- Discuss the tradeoffs/compromises connected with your water supply system and how your design reduces or eliminates these tradeoffs.
- Explain the types of engineering involved in designing your resilient city and what kinds of engineers were most helpful.

✷ **Conclusion**: The Impact of Your Resilient City.

Share why people want to live in your city and what makes it a great place to live. Tie together the potential effects of a specific drinking water issue and the need for a resilient water supply system. Summarize how the design of your water supply system will keep the people in your city safe and healthy.

See page 67 for a student handout version of the Suggested City Essay Outline. After you've gone over everything the students need to know about their outlines, check in with each team. First the team should list what they want to say in each section. Then suggest that they divide the sections so that everyone writes at least one part of the draft. When it's time to write the final version, they'll have plenty of material to work with. Also remind students that they can include up to four graphics in their essay.

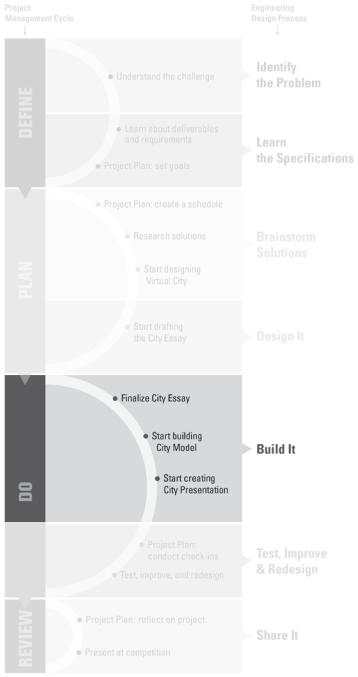
REVIEW THE CITY ESSAY RUBRIC

Before students begin their drafts, tell them to review the rubric. It is on page 68 and at futurecity.org/resources (filter for Rules & Rubrics).

DO

Build It

During the Build It stage of the engineering design process, students create their project deliverables. They finalize their City Essay, build their City Model, and write and practice their City Presentation. As they work, students use the Project Plan to conduct check-ins to make sure their project stays on track. Project managers refer to this third part of the project cycle as the Do stage.



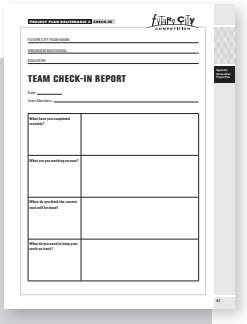
Project Plan: Conduct Check-Ins

As students move into the Build It stage, they should review the requirements for the Future City deliverables and make sure they're working towards meeting them. They may find it necessary to change responsibilities among team members as some tasks are completed and new ones begin.

Conducting regular check-ins will help students monitor their work. Ask each team for a quick verbal check-in every time you meet, so that students keep an eye on their schedule and tweak it frequently. Check-ins will also encourage students to become adept at summing up their progress across deliverables for you and the other teams.

ONLINE

For more tips on conducting check-ins, visit the Do section of Leading Your Team at futurecity.org.


TEAM CHECK-IN REPORT

PROJECT PLAN DELIVERABLE

Students must submit one Check-In Report from **Part 3: Conduct Check-Ins** as part of their Project Plan deliverable. Encourage them to write about an important point in their project, such as when they solved a problem, made a critical revision, or reached a major milestone. Find the Check-Ins template on page 47 or download at futurecity.org/resources (filter for Competition Forms & Project Plans).

Finalize the City Essay

It's time for students to look at the rough draft of their essay and to turn it into the final, polished version. Guide students through this important phase of writing according to your own methods. If you don't have a favorite way of helping students work in groups to complete essays, you can use the following approach.

If each team member wrote the rough draft of one section of the essay, tell the team to put the sections in order and read through them together.

Next comes a group editing process. Students are likely to find repetition and will need to decide where to cut and where to keep content. They will also need to add connecting sentences so that each section flows logically to the next. If they see any errors in spelling or grammar, they can catch them now. Remind students to check their essay against the City Essay Rubric on page 68 or download it at futurecity.org/resources (filter for Rules & Rubrics).

Once they have a near-final draft, you or the team mentor should read it to give the students feedback. Together, students can decide how to make changes to their essay based on this feedback. Then one student should be in charge of writing the final version. Everyone on the team should read it one last time and make sure their essay is in great shape.

Explore Scale

Before students begin their City Model, introduce the concept of scale.

Scale is a very important requirement for the City Model. Teams should think carefully about the most appropriate scale for their model, but which scale to use is up to the students. Factors to consider include the geographical location and terrain of their city, its layout, the level of detail they wish to include, and cost. If students choose too small of a scale, they may have trouble finding objects to build with; too large of a scale may prevent them from including all the areas and city zones that they would like to display.

Tell students that engineers use scale models to test their design ideas at an early stage of development without the risk of creating a full-sized model. If you have access to your school's blueprints, compare these drawings with familiar school buildings and rooms to illustrate the concept of scale.

Share the following terms:

- "Scale" is the ratio between two sets of measurements.
- "Scale drawing" is a drawing that uses scale to make an object smaller or larger than the real object.
- "Scale model" is a proportional model of a three-dimensional object.

RESOURCES FOR EXPLORING SCALE

Visit futurecity.org/resources (filter for Activities & Background Info) and continue exploring scale:

- Scale: Background Information
- Scale: Key Terms & Concepts
- Introduction to Scale: Learn how to use ratios to create a scale drawing.
- Plan and Elevation View: Architects and engineers use sketches as a way to communicate and convey their design ideas to others. This activity introduces students to creating scaled drawings.
- Proportions, Ratios, and Scale Drawings Activity: Apply learning about proportions, ratio, and scale to create a scale drawing of a room.
- Scale Map Activity: Plan the City Model by creating a two-dimensional city map.

Build the City Model

Building the model is one of the most exciting aspects of the competition. Start your students off by handing out and reviewing the **Build Your City Model** handout on page 73 and at futurecity.org/resources (filter for Activities & Background Info). It's full of valuable information about ways to create different parts of the model, questions to keep in mind, and tips for the moving part component.

City Model Resources

Future City has several resources to help students develop their model. Below are a few highlights. Find them and more in the Appendix: Deliverables starting on page 71.

- **City Model Requirements:** Make sure the team is familiar with the requirements (go to page 71).
- **Build Your City Model student handout:** This handout offers questions to consider and model building tips.
- **Past Models:** Get inspired! See models that teams have created over the years at futurecity.org/gallery.
- **Moving Parts Video:** Get ideas about different kinds of moving parts at futurecity.org/resources (filter for Webinars & Videos).
- **City Model Rubric:** Review the rubric on page 75 and at futurecity.org/resources (filter for Rules & Rubrics).

EXPLORE FURTHER: MODEL CONSTRUCTION

Visit futurecity.org/resources (filter for Activities & Background Info) and continue exploring strategies for constructing models.

- Model Construction: Key Terms & Concepts
- Model Construction: Background Information
- What is a Model? Activity: Examine different types of models and discuss why they are useful.
- Plan-Relief and Architectural Models Activity: Create and compare two-dimensional floor plans and three-dimensional models of a classroom.
- Building Strong Activity: Build a paper structure that will support a book.

Remind students that as they work toward completing the deliverables, they will be moving back and forth between the different phases of the design process. This is natural. Engineers go back and reevaluate or refine their solution as the need arises; sometimes the best ideas are those that are not selected first!

Create the City Presentation

The City Presentation gives students an opportunity to showcase all that they have accomplished and learned in the Future City Competition. Set a celebratory tone for students! That way their presentations will convey their enthusiasm for, and pride in, their future city.

Start your students with a review of the Future City objectives: to design and create a city that exists at least 100 years in the future and addresses this year's challenge, Clean Water: Tap Into Tomorrow.

Help students visualize what they will be creating by watching presentations from last year's winning teams at futurecity.org/gallery. Then discuss the videos by asking the following questions:

- What made the presentation engaging?
- What features made the city appealing, unique, and futuristic?
- How did the team incorporate last year's challenge into the city design?
- If you had to change one thing about the city's design, what would it be?
- What will you need to do to prepare for your own presentation?

City Presentation Resources

Future City has multiple resources to help students create fantastic presentations. Below are a few highlights. Find them and more starting on page 78.

- **City Presentation Requirements**: Make sure students understand the requirements.
- **City Presentation Rubric:** on page 80 and at futurecity.org/resources (filter for Rules & Rubrics).
- **Past Presentations:** Watch prior year's winning teams presenting at Finals at futurecity.org/gallery.

Another resource to use is the **City Design: Questions to Consider** student handout that the team used when writing their City Essay. Encourage students to revisit their answers to these questions and pick out what's most important and interesting to say in their presentation. They can't say everything; they have to pick and choose. In addition, you can suggest that the students consider these questions:

- What visual aids and props will you use to enhance your presentation?
- How did the engineering design process and project management cycle help you plan your city?
- How can you show the way you use teamwork? (For example, do you share presentation tasks, do you support each other during the presentation, do you display equal amounts of knowledge?)

GETTING READY FOR THE COMPETITION

Regional Competitions are fast approaching. Make sure you've got things covered by reviewing the Final Checklists (page 84).

PREPARE FOR YOUR PRESENTATION

SCRIPT

Students may not know how to prepare for the presentation. Share the tips below with them. They'll gain confidence as they talk it through and decide what to say about their future city.

1. Create an outline of main points. Your City Essay outline is a good starting point.

2. Write a script based on your outline. The script is what each member of the team will say during the presentation. It needs to sound natural and not as if you're reading your essay out loud.

3. Decide which team member will say which part of the script. Write each person's lines on note cards and practice at home. Get really comfortable with your part, so that you don't spend the whole presentation staring at your note cards! They're just there if you forget something. Mostly you'll be looking at your audience, because you know what you want to say.

4. Take advantage of moments to be especially creative. These are at the beginning and the end of your presentation. In the beginning, you want to grab the attention of your audience. At the end, you want to make the audience wish they could live in your city!

5. Use your City Model. It's your most important visual. Point out key features and interesting landmarks. You can also use pointers, display boards, costumes, and brochures during your presentation. (Remember that there are specified size limitations for these materials.) Check the rules starting on page 85 of the Handbook.

6. Dress appropriately for your presentation. You can wear costumes that work with the role that you're playing.

7. Review the special awards that your region offers. This is a great opportunity to show off your knowledge in these areas. Refer to your regional website for specific special award categories.

8. Think about the questions that the judges (and special award judges) may ask. The **Practice Questions** student handout available in October is a great resource (futurecity.org/resources filter for Handbook & Student Handouts). Have parents or your mentor act as judges and ask the practice questions.

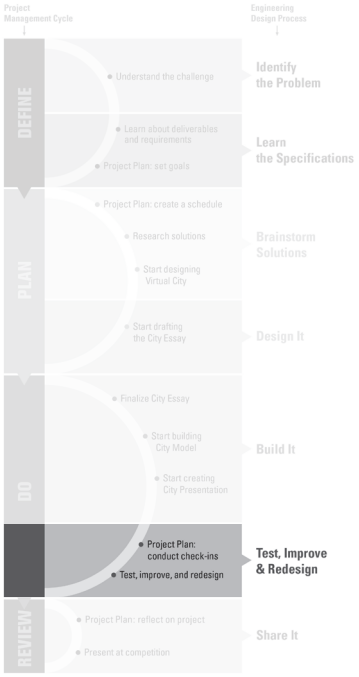
LEARN FROM OTHERS

Share one or more of the following presentations: NineTalks by Impressive Kids at: **blog.ted.com/9-talks-by-impressive-kids/**

Discuss what made these presentations engaging. What did students notice about the speaker's body movements and voice? How does the speaker use research, stories, and questions to hook the audience and convey a message? Encourage students to emulate effective public speaking techniques in their own presentations.

DO

Test, Improve, & Redesign



In the Test, Improve, and Redesign stage of the engineering design process, students evaluate their solutions, get feedback from others, and make improvements based on this feedback. They'll continue to monitor their project's progress through frequent check-ins with you and their teammates. The goal is to make sure their project is the best that it can be.

During this stage, students carefully review the rubric for each deliverable to ensure they have met all of the requirements. They should also get as much feedback from you and their mentor as possible on each competition deliverable. At this point, feedback should be specific and actionable—students should understand exactly what they need to do to implement your feedback.

Practice the Presentation

Effective presentations are the result of thorough preparation. Share these tips with your students to help them prepare.

- Rehearse your presentation (including all stage movements). If possible, video your team delivering your presentation. Ask friends, family members, and your mentor to be your audience.
- Practice your presentation in front of your class or other students. Encourage classmates to ask you questions about your city and its unique features. They can use the rubric to help give good feedback.
- Practice answering the **Practice Questions,** which are available in October at futurecity.org/resources (filter for Handbook & Student Handouts).
- Know the material well enough that you don't have to rely on notes.
- Take turns being coach and presenter. After each presentation, have peer coaches discuss the following:
  - What parts of the presentation were clear and informative?
  - Were there any points they didn't understand?
  - What was one thing they liked about how their peers presented?
  - Did the presenters make eye contact? How were their gestures, posture, tone of voice, and pace of the delivery?
  - How did the presenters use the model?

Final Preparations

When students are satisfied that they have met the requirements for each deliverable, they should prepare their deliverables for online submission or presentation at the competition.

Make a copy of the **Final Checklists** for each student. See page 84 or download at futurecity.org/resources (filter for Handbook & Student Handouts). Give the team time to look through every line on these lists. Then check in with the team to see what they still need to finish. Make sure students have a concrete plan for tying up loose ends.

Now is also a good time to fill out the competition forms. You can download them at futurecity.org/resources (filter for Competition forms & Project Plan):

– Media Waiver
– Honor Statement
– Competition Expense Form
– Home School Affidavit (if applicable)

ONLINE SUBMISSION PROCEDURES

All teams must submit their Virtual City, City Essay, and Project Plan via the online submission center at futurecity.org. Submission instructions are available from your Regional Coordinator or at futurecity.org/resources (filter for Competition Forms & Project Plan).

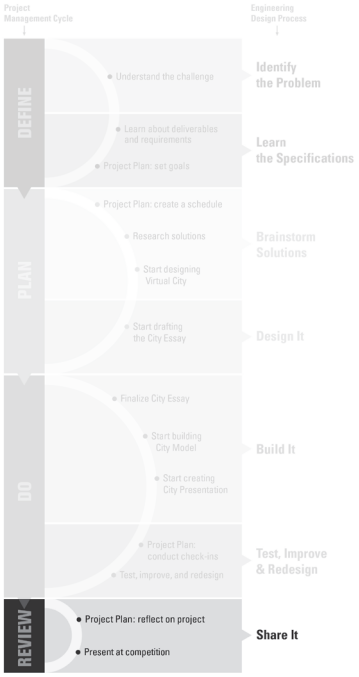
ONLINE

DUE DATES

Each region sets its own schedule. Regional due dates can be found at the online submission center or by contacting your Regional Coordinator.

REVIEW

Share It



The Review stage is where students look back and reflect on all that they have accomplished—an important step that both engineers and project managers take in any project. Here students will complete the final step of the engineering design process—Share It—by presenting their work to others and celebrating their accomplishments. Now is the time to reflect on everything they've done and complete their Project Plans.

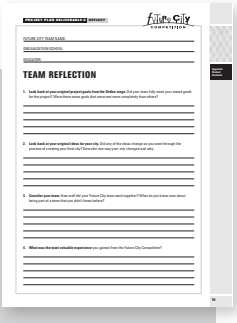
Project Plan: Reflect on Your Project

During this final stage, students reflect on their Future City experience by reviewing and assessing the process and end products. They consider both how well the project succeeded and any lessons learned.

Let students know that reflecting on their project allows them to consider what worked and how they might do things differently—information that can help make their next projects easier. Reflection is also a great way to prepare to answer the judges' questions at the competition. You can find the **Project Plan Part 4** template on page 49 or you can download it at futurecity.org/resources (filter for Competition Forms & Project Plan).

ONLINE

For more tips on reflection, visit the Review section of Leading Your Team at futurecity.org.


TEAM REFLECTION

PROJECT PLAN DELIVERABLE

Students must submit **Part 4: Reflect on Your Project** as part of their Project Plan deliverable. All teams must submit one complete Project Plan document via the online submission center at futurecity.org. Submission instructions are available from your Regional Coordinator or at futurecity.org/resources (filter for Handbook & Student Handouts.)

Present Your City

The presentation is a very exciting moment for students and the culmination of months of work. Although presenting at Regionals or Finals is a wonderful experience, sharing can also be done in class in front of a group of educators, parents, friends, and mentors.

Performance Tips

Here are a few final tips to share with your students:

- Sleep well the night before the competition.
- Eat a healthy breakfast.
- Remain calm; no one knows your city better than you!
- Be poised and confident; there are no wrong answers.
- Maintain eye contact with the judges.
- Use signals or gestures so that you will know which teammate will answer a judge's question.
- Project yourself. Put energy in your voice, be confident, move with purpose, face the audience, and smile!

All team members will receive a certificate of participation at the Regional Competition.

Congratulations on completing your city of the future!

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Note: All forms (including the Media Waiver, Honor Statement, Competition Expense Form, and Home School Affidavit) are available online at futurecity.org/resources (filter for Competition Forms).

DELIVERABLE #1:

Project Plan

10 POINTS
DUE: ONE WEEK BEFORE REGIONAL COMPETITION

Students work with their team to complete a four-part project plan that will help them stay organized, focused, and on schedule as they complete their other Future City project deliverables.

Visit Leading Your Team at futurecity.org to learn more about how the Project Plan will help your team successfully complete their future city.

What Is a Project Plan?

A project plan is a tool engineers use to manage their work. It's where Future City participants record their project goals, plan how they'll complete the competition deliverables, and monitor their project's progress. A well-crafted project plan will help students stay on track as they use the engineering design process to design and build their solution. It's like a roadmap that students refer to as they move through the competition, but it is also changeable. Decisions made at the beginning of the project may turn out to need revising!

Project Plans Take Many Forms

What a Project Plan looks like depends on the project and the team; a plan needs to work with the needs of the project and the style and preferences of the team. For this competition, students start with the **Project Plan template** starting on page 43. It has four parts that align with the project management cycle stages: Define, Plan, Do, and Review. Within each section, students have the leeway to make the plan work for them. In fact, we encourage students to make the Project Plan their own, in whatever ways it will best meet their needs for the competition.

NO RUBRIC FOR THE PROJECT PLAN

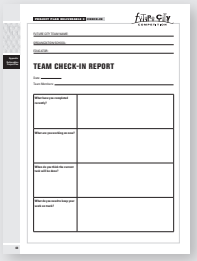
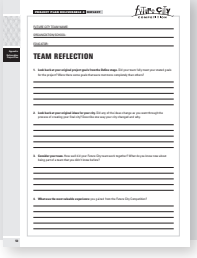
Note: There is no rubric for the Project Plan, but you still need to hand it in. Fully completed plans (with all four parts) earn 10 points. Partially completed plans may earn 5 points.

ONLINE

An editable Word version of the Project Plan template can be downloaded at futurecity.org/resources (filter for Competition Forms & Project Plan). You can also see examples of Project Plans from previous years in the Gallery section of futurecity.org/gallery.

As the team puts together its Project Plan, team members need to keep the four parts in mind. You can copy this chart on the board or chart paper so the kids can see which stage of the competition each part addresses.

Project Plan Parts

PROJECT PLAN PARTS	PROJECT MANAGEMENT STAGE
PART 1: SET GOALS Students describe what they hope to achieve by the end of the project. They also ensure that goals are realistic by identifying resources, constraints, and assumptions.	**DEFINE: LEARN THE SPECS** 
PART 2. CREATE A SCHEDULE Students plan how they'll complete each deliverable.	**PLAN: DESIGN IT** 
PART 3. CONDUCT CHECK-IN SESSIONS Students monitor their project's progress to keep on schedule, meet their goals, and see where the plan needs tweaking.	**DO: BUILD IT & TEST, IMPROVE, REDESIGN** 
PART 4. REFLECT ON THE PROJECT Students reflect on what they did and how they did it, a great way to prepare for the competition and make their next projects easier.	**REVIEW: SHARE IT** 

Project Plan Requirements

- All four parts of the Project Plan are included in one document that is saved as a PDF.
- Teams submit their Project Plan document (containing Parts 1–4) via the online submission center at futurecity.org. Submission instructions are available from your Regional Coordinator or at futurecity.org/resources (filter for Competition Forms & Project Plan).

Project Plan Resources

- **Project Plan template:** The template includes instructions for what the Project Plan has to include as well as space for students to complete each of the four sections. It starts on the next page or can be downloaded at futurecity.org/resources (filter for Competition Forms & Project Plan).
- **Training for Educators:** If you would like guidance on how to lead your team, see Leading Your Team online training at futurecity.org.
- **Final competition checklist** on page 84.

Competition Scoring

Teams who submit their completed Project Plans on time will receive 10 points. Teams who submit incomplete Project Plans may earn 5 points. Remember, there's no rubric for this deliverable. Teams that do not submit a Project Plan will receive zero points.

Scoring Deductions

5–10 points
Late submissions may be accepted with a penalty. Check with your Regional Coordinator before the deadline to find out if this is an option in your region.

PROJECT PLAN 1

SET GOALS

INSTRUCTIONS

First, think about the resources, constraints, and assumptions you have about this project. Use this information to help you come up with your goals. Write all of them down in the table on the next page.

Project Resources are what you can use to research, design, and create your city. People to ask for advice; skills you, your team, and your mentor can offer; and equipment and supplies from school or home go in this section.

Constraints are what limit your options on this project. You only have a certain amount of time, money, and expertise, for example. Do you have enough computers? Are the competition rules posing restrictions? What about the requirements of each deliverable? The size of your group? List constraints in this section, and include ways to work around as many of these constraints as you can think of.

Assumptions: What are you pretty sure is true about this project? In this section, you write down things like how much time you think you have, what materials you know you can get ahold of, how you think your group will work together, and what you assume will be difficult to accomplish.

Project goals describe what you hope to achieve for the project (rather than for your city). Knowing what your resources, constraints, and assumptions are can help you pick project goals. Project goal examples include coming in under budget, hitting our due dates, working well as a team.

Use the space below to brainstorm ideas, and write your final thoughts in the chart on the next page.

FUTURE CITY TEAM NAME:

ORGANIZATION/SCHOOL:

EDUCATOR:

List resources, constraints, assumptions, and goals for your project below

Our project resources:
Constraints on our project:
Assumptions we have about our project:
Our goals for this project (pick at least two more goals): 1. Our team will successfully create a resilient water supply system for our future city. 2. 3. 4.

PROJECT PLAN 2

SCHEDULE

INSTRUCTIONS

To create your schedule, figure out what needs to be done and in what order. Follow the process outlined here or use your own.

Step 1: List Tasks for Each Deliverable.

Begin by brainstorming tasks for each deliverable. Write them on index cards or sticky notes. You can color code them so that everything to do with one deliverable, such as the City Essay, is one color, whereas everything to do with the City Model is another. If each task is on its own card, it's easy to move them around as the schedule changes.

Step 2: Put Tasks in Order

Now it's time to think about the sequence in which things should be done. Arrange the cards for each deliverable in a logical order.

Step 3: Estimate Time Each Task Takes

Think about how much time tasks will take. You can't know exactly, but make your best guess. Write this in pencil on each task card, so that it's easy to erase and change if the task takes less or more time than you thought.

Step 4: Assign Roles

Next decide who will get the work done. Assign team members to be responsible for each task and record their names on the cards.

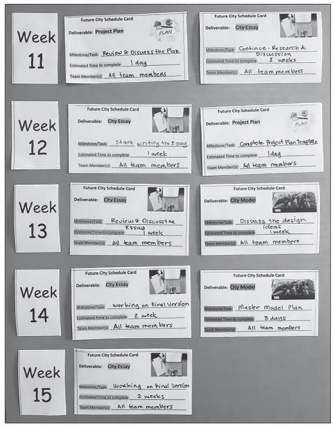
Step 5: Make a Schedule

On a bulletin board, white board, or chart paper on the wall, create a giant schedule that you can tack the cards on. Things will change along the way—so make sure you can make changes easily in order to revise your schedule.

Show Us Your Style!

An image of your schedule is part of your Project Plan deliverable. What does your schedule look like? Is it a large wall calendar, shared online calendar, something else?

TEAM SCHEDULE – Week 11-15



FUTURE CITY TEAM NAME:

ORGANIZATION/SCHOOL:

EDUCATOR:

Instructions: In the space below, insert a photo, drawing, sample planning text message—anything that captures how your team scheduled your project.

TEAM SCHEDULE

PROJECT PLAN 3

CHECK-IN

INSTRUCTIONS

Check-ins with teammates and your educator help you monitor progress and ensure that you're meeting deadlines. Most of these check-ins can be quick conversations. But one of them needs to be written down as part of your Project Plan deliverable. Part 3 of your Project Plan is where to put this written check-in.

You can also make copies of the Check-In Report template and use it to update all project stakeholders (team members, educator, mentor) on the status of your Future City project as often as you want.

TIP: BEFORE EACH CHECK-IN

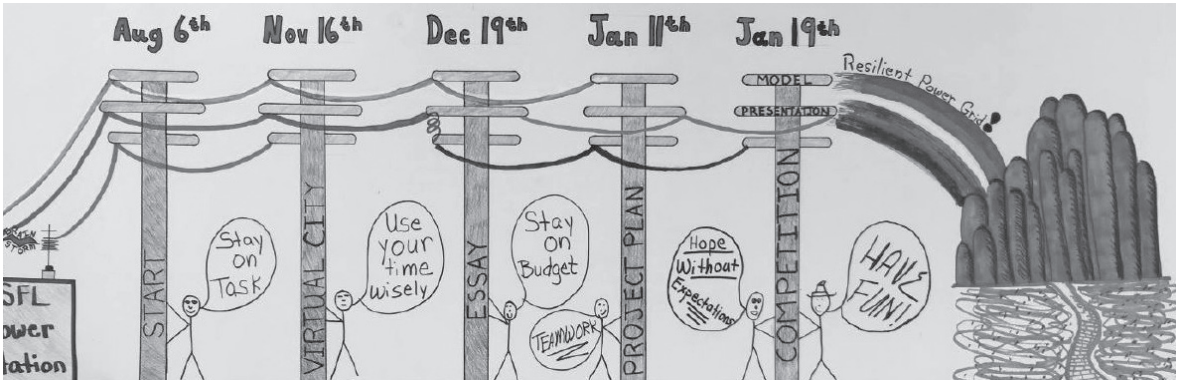
- Review your schedule and the requirements for each deliverable.

AFTER EACH CHECK-IN

- Make changes to your schedule as needed.

Show Us Your Style!

Submit one report that illustrates an important point in your project, such as when you solved a problem, made a critical revision, or reached a major milestone.



FUTURE CITY TEAM NAME: _____

ORGANIZATION/SCHOOL: _____

EDUCATOR: _____

TEAM CHECK-IN REPORT

Date: _____

Team Members: _____

What have you completed recently?	
What are you working on now?	
When do you think the current task will be done?	
What do you need to keep your work on track?	

PROJECT PLAN 4

REFLECT

INSTRUCTIONS

Part 4 of your Project Plan is a place to reflect on what you learned from the experience of participating in Future City. Each project teaches us a lot, and your thoughts now can make your next project go more smoothly.

Working as a team, record your responses to the questions on the next page.

TIP: PREPARE FOR THE COMPETITION

Judges ask questions just like these. Reviewing your project and answering these questions are a great way to prepare for your presentation!

FUTURE CITY TEAM NAME:

ORGANIZATION/SCHOOL:

EDUCATOR:

TEAM REFLECTION

1. **Look back at your original project goals from the Define stage.** Did your team fully meet your stated goals for the project? Were there some goals that were met more completely than others?

2. **Look back at your original ideas for your city.** Did any of the ideas change as you went through the process of creating your final city? Describe one way your city changed and why.

3. **Consider your team.** How well did your Future City team work together? What do you know now about being part of a team that you didn't know before?

4. **What was the most valuable experience** you gained from the Future City Competition?

DELIVERABLE #2:

Virtual City

48 POINTS

DUE: CHECK DATE WITH REGIONAL COORDINATOR

Students design a Virtual City using SimCity software and present their city's progress via a slideshow document.

SimCity is a great learning tool for students to understand the complexities of city design as they develop their future city. They will see how decisions (like where they place roads, power plants, or industrial zones) affect their city's growth and development.

For this deliverable, students choose two goals that they want to achieve in their Virtual City. At two points during the development of their Virtual City, students will document its development and their progress toward meeting their two goals. This emphasis closely follows the engineering design process. It also concentrates on students demonstrating their learning and sets them up to apply that learning to their City Essay, City Model, and City Presentation.

Creating a Virtual City

Before your team begins to build its city, it needs to select two goals from the Sample Goal List on page 53 or set their own. Next, the team should brainstorm strategies on how they might achieve those goals. After that, they can begin building their city.

PROGRESS REPORT #1

When the Virtual City reaches a population range of 8,000 to 20,000 Sims, the team needs to pause to record their city's progress in the Virtual City Presentation Template. When the team reaches this point, we recommend saving the SimCity. This allows the students to compare how their city is developing over the two phases. Instructions on how to save a SimCity game are available in the SimCity Download Instructions at futurecity.org/resources (filter for SimCity).

SIMCITY SCREENSHOTS

"How to Take a Screenshot in SimCity" offers step-by-step instructions for taking screenshots on both a PC and Mac. Download it at futurecity.org/resources (filter for SimCity).

VIRTUAL CITY: A TRIAL RUN

The Virtual City is a trial run before kids design their competition city, but it is not a prototype of their city. Rather it's a chance for kids to experiment and get ideas they can apply to their future city.

Progress Report #1 includes the following items.

1. **Four screenshots of their city including:**
   - One bird's-eye view of the city to give an overview of the layout. Establish a fixed location where the team will take their screenshots from. This fixed location will be the same for progress report #1 and #2.
   - One screenshot showing the budget panel details. These include expenses, income, and taxes.
   - Two screenshots showing the population panel details. These include one screenshot showing "workers" and "shoppers" and a second screenshot showing "students," "tourists," and "homeless."
2. **A completed Benchmark Chart**
   The information here is a simple reporting of the status of the city. Download the Benchmark Worksheet, which includes tips on how to locate the required information, from futurecity.org/resources (filter for SimCity).
3. **A completed Progress Toward Goals Chart**
   The team will list its two goals, report on the status of each, and provide evidence that supports the status it has selected. The team will also provide two screenshots that illustrate the progress they are making toward each goal.
4. **Strategies.** The team will share what strategies worked and didn't work, and share strategies they will try in the next stage of development.

PROGRESS REPORT #2

Once the city's population reaches 20,000+ Sims, the team can complete the Virtual City Presentation Template. They'll fill out Progress Report 2 as well as address lessons learned about city planning and how they will apply this to the other Future City deliverables.

Virtual City Requirements

Teams will:

- Use SimCity software to design their virtual city
- Name their city after their team **(the city name and the team name have to be the same)**
- Complete the Virtual City Presentation Template using Powerpoint, Word, or Google Slides
- Not add slides to the template
- Choose a region in which to build their city (any region is acceptable)
- Record their city's progress at two different points in time by taking screenshots that capture the layout of the city, the population size, and budget details
- Not use sandbox mode
- Create their cities in offline mode. (Although online mode is acceptable, the game should be private so no other players can make modifications to the city.)
- Turn off random disasters
- Try to build a city without using cheat codes
- Submit their final slideshow as a PDF

A HELPING HAND

Future City encourages teams not to use SimCity cheat codes. However, sometimes cities run into problems and need a bit of help (in the game and in the real world). If your team chooses to use a cheat code, please record this information on the Benchmark Chart under Financial Aid. And then work diligently to eliminate or reduce your city's reliance on financial assistance.

SIMCITY NOT WORKING ON SCHOOL COMPUTERS?

If you're not able to access SimCity via school computers, consider assigning team members to work on it at home. To do this, create generic usernames and passwords that you can share with the students. (This allows you to reuse codes year after year.) Another option is to bring in a personal laptop for the team to work on the Virtual City.

Virtual City Resources

- **SimCity codes:** If you haven't requested your SimCity codes yet, log into your Future City account at futurecity.org and click on Update Your Program Details under the Educator Pages tab. Once completed, your codes will be available on your Educator Page (after July 15, 2019).
- **Virtual City Presentation Template:** Insert your city details in this template downloadable at futurecity.org/resources (filter for SimCity).
- **Sample Virtual City Presentation:** This slideshow gives students an example of what they're trying to do and shows them what information to report. Download at futurecity.org/resources (filter for SimCity).
- **SimCity Benchmark Worksheet:** Students use this worksheet to record their Virtual City's details before entering them into the template. It also contains helpful tips on how to locate the necessary information. Go to futurecity.org/resources (filter for SimCity).
- **Virtual City Rubric:** Students should refer to the rubric to make sure they're satisfying all of the criteria for this deliverable. See page 54 or go to futurecity.org/resources (filter for Rules & Rubrics).

Competition Scoring

Teams can earn up to 48 points for their Virtual City. Make sure they have thoroughly covered these categories in the rubric to maximize points:

Specs	12 points
Test It, Improve It	18 points
Conclusion	3 points
Judge Assessment of Design & Process	15 points
Total	**48 points**

Scoring Deductions

5–10 points
Late submissions may be accepted with a penalty. Check with your Regional Coordinator before the deadline to find out if this is an option in your region.

Sample Virtual City Goals

Before developing the city, teams need to choose two goals and two corresponding pieces of evidence from the list below or set their own:

SimCity Goal	SimCity Measurement
City has a resilient, reliable water supply	• At least two different water supply facilities • Water supply sources are located in separate areas of the city to minimize susceptibility to threats • All water sources are clean and healthy (free from pollution and germs)
City has a resilient power grid	• At least two different generating sources • At least one generator less susceptible to the most likely natural disaster (ex: hurricane in coastal city, earthquake in mountains, tornado in plains and desert, heat in desert) • All generating sources located in separate areas of city
It is a green city	• Power source is wind or solar only • Sewage treatment plan is operational • Water filtration system in place (if needed for water pollution) • The city has a wave generator
The city is free of pollution	• No water, air, ground, or radiation pollution • High-tech or manufacturing industry only • Sewage treatment plan is operational • Water filtration system in place (if needed for water pollution)
The city is well managed	• Mayor rating at least 75% • Balanced budget with no loans, cheats, or gifts • Tax rates no more than 10%
Public transit available to all Sims	• At least two types of public transit systems • Integrated transit systems (working together to get Sims where they want to go) • At least 50% of low- and medium-wealth Sims using the public transit systems • Wait times no more than 20 minutes
City is a happy, healthy place to live and work	• Excellent health facilities with low sickness • Injury rates = 0 deaths • Less than 10% of population is sick/injured • Parks and recreation facilities (20% of Sims visiting) • Parks within walking distance (4 to 5 blocks)
City is a safe place to live and work	• Excellent police coverage across entire city (0 crimes committed) • Excellent fire coverage across entire city (0 buildings burned down)

Virtual City Rubric

0	1	2	3
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills less than 50% of requirements.	**Good** Average-Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

I. Specs (12 points)	0	1	2	3
1. Presentation quality and content • Spelling, grammar, neatness • Followed template – Slide count didn't exceed 23 – Did not use sandbox mode – Complete goals, benchmarks, and required screenshots – Same city throughout	Didn't follow template. Sloppy, with errors. Used Sandbox mode.	Some errors. Followed the template. Missing much of required information or not using the same city throughout.	Few errors. Followed the template. Missing some of the required information. Same city throughout.	No errors. Adheres to template and all requirements for assessments and goals. Same city throughout.
2. Goals • Set two goals • Goals are challenging and measurable • Same goals used throughout slideshow	No goals.	Fewer than two goals, or goals change from one phase to the next. Or, goals not measurable or challenging.	Two goals that are measurable and somewhat challenging. Same goals throughout.	Two goals that are challenging and measurable. Same goals throughout.
3. Two reporting stages • Virtual city assessment (benchmarks) and reporting at two points • Each stage exhibits enough development to show progress	No reporting phases.	Fewer than two reporting phases.	Two reporting phases. But little progress between phases.	Two reporting phases showing clear progress between each.
4. Screen shots • Screen shots show zoning, budget details, population details, and goal progress • Bird's-eye shots are from a consistent point/orientation in both phases • All of the screenshots documenting a phase are taken at same point in time	No or few screen shots.	Some of required screen shots, but not consistent orientation or time point.	Most of the required screen shots. Consistent orientation and time.	All required screen shots. Consistent orientation and time. Includes shots and details to illustrate important goal progress points.
II. Test It, Improve It (18 points)	**0**	**1**	**2**	**3**
5. Benchmark assessment and analysis of progress • Accurate and fair assessment of features in city • Includes information to support goal progress	No or inaccurate assessments.	One assessment that is relatively accurate, but incomplete.	Benchmark assessment at each phase. Relatively accurate and complete assessment of city features.	Benchmark assessment at each phase. Extremely accurate and complete assessment of city development.
6. Analyzing strategies • For both reporting phases, report on strategies tested during the simulation • What worked and what didn't work	No report on strategies.	One report on strategy analysis. Incomplete analysis.	Reports on strategy analysis for each phase. Analysis somewhat complete.	Reports on strategy analysis for each phase. Thorough analysis toward meeting goals.

ONLINE **DOWNLOAD THIS RUBRIC** at futurecity.org/resources (filter for Rules and Rubrics).

Virtual City Rubric

0	1	2	3
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills less than 50% of requirements.	**Good** Average-Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

II. Test It, Improve It (18 points) (Continued)	0	1	2	3
7. Progress toward achieving stated goals • For each reporting phase, city should show steady progress toward achieving stated goals • Note: Actually achieving goals is not required	No progress toward achieving goals.	One or two reports on goal progress. Not much advancement toward goals evident.	Reports on goal progress for each phase. Advancement evident, but could be more clear and consistent.	Reports on goal progress for each phase. Clear and consistent advancement toward meeting goals.
8. Refine design • Using results of assessment, determine updates to plans and measurements as needed to make further progress toward goals in the next phase(s) of the simulation	Updates to plans not addressed.	Plan updates are unrelated to goals.	Plan updates for next phase are reasonable, appropriate and address most goals.	Detailed plan updates and measurements for next phase are reasonable, appropriate and address all goals.
9. Implement design changes and continue testing • Adjust or change the virtual city as planned to further goal progress • Test changes with the simulation and assess results	No changes and no further goal progress.	A few changes added to further goal progress. Not much testing of changes.	Some of planned changes were added to the simulation and tested.	All planned changes were added to the simulated city. Thoroughly tested and assessed for effectiveness.
10. Budget manipulation • Includes use of cheat codes, gifts or other budget manipulation techniques • Allowable if: – Recognized in benchmarks and analysis – Strategies developed and implemented to eliminate dependence on budget help	Cheats or other manipulation used, no admission.	Budget manipulation used throughout simulation. No effort to stop.	Budget manipulation used. Good effort and progress to eliminate dependence on assistance.	No budget manipulation or excellent and successful efforts to eliminate dependence on assistance.
III. Conclusion (3 points)	**0**	**1**	**2**	**3**
11. Conclusions & lessons learned • What team learned from the simulation about city design and operation • What lessons will the team apply to their essay, model, and/or presentation?	No lessons learned about city design/operation. No lessons to apply to other deliverables.	Somewhat clear summary of city design/operation lessons. Brief description of how team plans to use simulation lessons in the rest of the project.	Clear summary of city design/operation lessons. Clear description of how team plans to use simulation lessons in the rest of the project.	Clear and thorough summary of city design/operation lessons. Clear and thorough description of how team plans to use simulation lessons.

CONTINUED ON NEXT PAGE

Virtual City Rubric

0	1	2	3
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills less than 50% of requirements.	**Good** Average-Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

IV. Judge Assessment of Design & Process (15 points)	0	1	2	3
12. Goals, city operation and design • Goals are significant to a well-designed, well-operated city • Overall well-designed, vital city showing significant growth, development and progress toward goals • Good city management as reflected in strong budget	Poor goal choice. Poor city development.	Good goals, but city is underdeveloped. Poor budget management.	Good goals. City somewhat well-developed, but could have made better progress toward goals. Good balanced budget management.	Excellent goals and city development. Significant progress toward achieving goals. Strong positive cash flow budget.
13. Quality of analysis • Analyzing and understanding results of simulation • Fair and honest assessment of what works and what doesn't	No analysis or complete misunderstanding of simulation results.	Little analysis or understanding of simulation results.	Clear analysis and insight of simulation results.	Clear and thorough analysis and insight into city operation and design as result of simulation.
14. Got It: strategic thinking • Developing reasonable and appropriate strategies for design changes/ refinements from the information in benchmark analysis	No reasonable or appropriate strategies.	Strategies somewhat reasonable or appropriate, but not effective in advancing toward goals.	Strategies reasonable and appropriate and somewhat effective in advancing toward goals, but could be better.	Strategies reasonable and appropriate and highly effective in advancing toward goals.
15. Got It: design-test-refine process • Using the simulation, applying the strategies, analyzing results • Lessons to apply to other Future City deliverables (essay, model, presentation)	No evidence of understanding the process or lessons to apply.	Some evidence of understanding the process. Lessons listed but could be improved.	Clear understanding of the process. Team learning and adapting to simulation and testing. Clear lessons to apply.	Clear and thorough understanding of the process. Team learning and adapting to simulation and testing. Clear and thorough lessons to apply.
16. Got It: city design and operation • Conclusions & lessons learned about city design/operation are significant and appropriate based on information given • Team learned lessons beyond the two original stated goals • Conclusions are thorough and illustrate understanding of simulation process	No significant or appropriate conclusions. No lessons learned beyond stated goals.	One or two somewhat significant conclusions. No lessons learned beyond stated goals.	Conclusions are significant, but missed some important areas. One lesson learned beyond stated goals.	Clear and thorough list of significant, appropriate conclusions. Two or more lessons learned beyond stated goals.

DELIVERABLE #3:

City Essay

60 POINTS

DUE: CHECK DATE WITH REGIONAL COORDINATOR

Students research and write a 1,500-word essay that describes the unique attributes of their city and provides a solution to this year's challenge.

The essay asks students to imagine what it would be like to walk down the main street of a city at least 100 years in the future. What would you hear, see, smell, and feel? How would the people who live in this future city describe it? What would make it futuristic and innovative?

As students draft their City Essay, they explore questions such as these and more to develop their future city. Students will think deeply about their city, its population, geographic location, cultural preferences, unique characteristics, and community needs. In addition, the essay asks students to thoughtfully address this year's challenge: Clean Water: Tap Into Tomorrow.

Clean Water: Tap Into Tomorrow Overview

We turn on the faucet and clean water flows out. Most of us don't think about how convenient it is to be able to drink, cook, wash, shower, flush, and water our yards whenever we want. We don't usually worry about whether water will flow from the tap, but plenty of engineers, city planners, developers, and other professionals think about it all the time. It takes expertise, planning, and constant work to keep a reliable water supply flowing. Unfortunately, people in many parts of the world cannot take clean water for granted. One in four people worldwide currently don't have access to clean water; that's 2 billion people. And it's estimated that by 2025, half of the world's population will be living in water-stressed areas—that is, areas where there is not enough water to meet everyone's needs.

Today's engineers, architects, and city leaders face the critical task of creating resilient cities. A resilient city withstands drought, flooding, big population changes, natural disasters, economic recessions, and other short and long-term threats. When it comes to a city's water supply system, resilience means providing adequate clean water for both residential and commercial uses under all possible circumstances. Resilience requires preventing and fixing leaks, identifying and removing contaminants, and making sure the supply of water always meets demand in the face of disruptions and longer-term changes. As a part of a resilient city, a reliable water supply ensures that clean and safe water is provided to all its residents for their well-being, to keep their communities stable and cared for, and the city economy strong and durable.

The students' challenge: Choose a threat to your city's water supply and design a resilient system to maintain a reliable supply of clean drinking water.

City Essay Requirements

- Students select a threat or stressor to the drinking water supply for their city based on its climate, geography, or issues specific to that city, such as rapidly growing or shrinking population, industrial base, or another factor.
- Although the focus of the essay is the water supply system, the general theme of resiliency should be evident in other aspects of their city as well.
- The essay cannot exceed 1,500 words and should be free of grammatical and spelling errors.
- The essay can include a maximum of four graphics.
- The essay must cite at least three sources of information used during the idea development process. MLA style is preferred; download guidelines from futurecity.org/resources (filter for Handbook & Student Handouts.)
- Students should use a variety of sources of information, such as interviews with experts, reference books, periodicals, and websites. (Note: Wikipedia is not accepted as a source of research.)
- The essay must be submitted as a Word document via the online submission center at futurecity.org. Check with your Regional Coordinator for the exact date.

City Essay Resources

Use these resources to help your students develop their essay. The first four items in this list are in the Appendix: Deliverables City Essay starting on page 59. They can also be downloaded at futurecity.org/resources (filter for Handbook & Student Handouts).

- **City Design: Questions to Consider:** These guiding questions will help students remember to research all the different aspects of their future city.
- **Clean Water: Tap Into Tomorrow Overview and Research Questions student handout:** This resource provides background information on water supply systems and guiding questions for student research.
- **Clean Water: Tap Into Tomorrow Real World Case Studies student handout:** Students will find these real-life examples of problems that were solved via innovative solutions both inspiring and instructive.
- **City Essay Sample Outline:** This outline explains what students should include in each section of their essay and how to organize their essay as well.
- **Clean Water: Tap Into Tomorrow Resources:** Start your students research with this preselected set of websites, books, and videos. Download the list at futurecity.org/resources (filter for Research Resources & Websites.)
- **City Essay Rubric:** Review this rubric with students so they understand how their essays will be evaluated. See page 68 or futurecity.org/resources (filter for Rules & Rubrics).
- **City Essays from past Finals Winners:** Analyzing essays from prior years will give students a strong sense of what they are aiming for in their own essays. Go to futurecity.org/gallery.
- **Research cards** help students track and organize the information they want to use in their essays. Go to futurecity.org/resources (filter for Research Resources & Websites).
- **Final competition checklist:** see page 84.

Competition Scoring

Teams can earn up to 60 points for their City Essay. Make sure they have thoroughly covered these categories in the rubric to maximize points:

Introduce City & Define Problem	15 points
Specs and Solutions	21 points
Judge Assessment of Solution	12 points
Writing Skills	12 points
Total	**60 points**

Scoring Deductions

5–10 points	Late submissions may be accepted with a penalty. Check with your Regional Coordinator before the deadline to find out if this is an option in your region.
10 points	Be sure to check your word count and do not exceed the 1,500-word limit.

City Design: Questions to Consider

As you research today's cities and brainstorm what your future city might look like, discuss these questions with your teammates. Remember that no city can provide everything. What are the most important elements in your future city? What tradeoffs do you have to make?

City Features

- Where is your city located?
- When was your city founded? What problems has your city had to overcome?
- How would you describe the people who live in your city?
- What are your city's distinctive natural features (e.g., mountains, oceans, rivers)?
- What is the climate like in your city?
- What does your city offer for entertainment, recreation, and cultural enrichment?
- What makes your city futuristic and innovative?
- What are the potential threats to the drinking water supply of your future city?

Zoning & Budget

- How is your city zoned? Are the zones separate or are there mixed-use zones (e.g., commercial and residential or commercial and industrial) in your city?
- What role does zoning play in helping your city respond to changes in population, business base, industry, or climate?
- How does your city fund its operations (e.g., utilities, infrastructure, and public services)?
- How does designing your future city's resilient water supply system affect your city's budget?
- SimCity connection: How did zoning impact your SimCity's growth and development?

Industry & Jobs

- What drives the economy in your city (e.g., tourism, manufacturing, education, sports, medicine, the arts)?
- What types of jobs are available to your citizens?
- How would a compromised drinking water supply disrupt your city's economy and the daily lives of its citizens?

Transportation

- How do your citizens travel around your future city? Is there more than one way for citizens to get around?
- Is your city accessible for citizens with mobility issues related to aging or a physical disability?
- SimCity connection: What did you learn from how your Sims moved around your Virtual City?

Environment & Energy

- What energy source(s) does your future city rely on? What are the costs and tradeoffs of different power sources?
- How does your city prevent and reduce water and air pollution?
- In what ways do environmental problems or threats threaten your city's energy supplies?
- SimCity connection: How did you power your SimCity?

Utilities & Services

- How does your city provide basic services (e.g., police, medical, education)?
- What emergency services does your city provide? How might your fire department be affected by a shortage of water?
- How does your city address the needs of vulnerable populations, such as the poor, the sick, the homeless, and the elderly?
- How does your city provide various utilities (water, sewer, waste management and recycling, electricity, Internet, etc.)?
- What are possible disruptions to residents' access to those utilities? What alternatives does your city provide?
- SimCity connection: Were your Sims happy with the level of services available to them?

Health & Recreation

- How does your city help support a healthy lifestyle for its residents?
- What role does access to clean water play in this healthy lifestyle—are there swimming pools, clean streams, or water parks?
- How does your city ensure equal access and opportunities for people with disabilities, low income, and older residents?
- What do people do in your city's public spaces?
- Where does your city's food come from? What mix or percentage of your food is grown locally? Regionally? Globally?
- How would a disruption in the supply of clean water affect the availability of food in your future city?
- How have your hospitals and medical services prepared for a temporary disruption in the clean water supply?

Housing

- Where do your residents live? Individual houses, apartments, or a mix?
- Are there any special features in your city's housing options?
- Where is housing located in your city?
- How is the water supply to your housing protected against threats?

Communication

- What forms of communication are most used by residents and businesses in your city? Which of these does the city provide?
- What impact could a power outage have on communication in your city?
- What alternate forms of communication does your city provide, especially for emergencies?

Water

- Where does your city's water come from? (a river, an aquifer, a reservoir, etc.).
- All cities are located within a "watershed" or water basin. Which watershed is your city located in? What are the threats to the watershed outside of your city that could potentially affect your city's water supply and water quality?
- Is there farmland near your city? If so, what crops are farmed, and how much water do they need? What happens with farm run-off?
- Has your city experienced extreme events like storms, floods, fires, and droughts that affected water supply and quality? How did this affect your city?
- How has the climate changed in your city over the past decades? Has it become warmer? Has it become drier or wetter?
- Does your city have up-to-date flood risk maps?
- Does your city have a resilience plan that looks at potential future threats to water supply? If so, how does it address these threats?

Brainstorm Your Own Questions

1.

2.

3.

Clean Water: Tap Into Tomorrow Overview and Research Questions

We turn on the faucet and clean water flows out. Most of us don't think about how convenient it is to be able to drink, cook, wash, shower, flush, and water our yards whenever we want. We don't usually worry about whether water will flow from the tap, but plenty of engineers, city planners, developers, and other professionals think about it all the time. It takes expertise, planning, and constant work to keep a reliable water supply flowing. Unfortunately, people in many parts of the world cannot take clean water for granted. One in four people worldwide currently don't have access to clean water; that's 2 billion people. And it's estimated that by 2025, half of the world's population will be living in water-stressed areas—that is, areas where there is not enough water to meet everyone's needs.

Today's engineers, architects, and city leaders face the critical task of creating resilient cities. A resilient city withstands drought, flooding, big population changes, natural disasters, economic recessions, and any other short or long-term threats. When it comes to a city's water supply system, resilience means providing adequate clean water for both residential and commercial uses under all possible circumstances. Resilience requires preventing and fixing leaks, identifying and removing contaminants, and making sure the supply always meets demand in the face of disruptions and longer-term changes. A resilient water supply ensures that clean and safe water is provided to all residents for their wellbeing, to keep their communities stable and cared for, and the city economy strong and durable.

Your Challenge: Choose a threat to your city's water supply and design a resilient system to maintain a reliable supply of clean drinking water.

WHAT IS A WATER SUPPLY SYSTEM?

A water supply system provides potable water, which is safe to drink. Water comes from rivers, lakes, aquifers (water beneath the ground), collected rainwater, and sometimes reused water. Water sources must be protected from pollution and from depletion. Public utilities treat all water to clean it of impurities and make sure it is potable; then water must be pumped to homes and businesses. A network of national, state, and local agencies, along with utilities, businesses, industries, and ordinary citizens, collaborates to protect source water, build and maintain treatment systems, and layout water transport structures. All of these elements are part of our water supply system. Sometimes a city has its own water utility, but often a water district serves a greater region.

Research Questions

For the competition, your team will choose one potential threat to your future city's clean drinking water. The problem should be plausible—a realistic possibility--for your city's location, climate, and urban challenges. As your team creates your city's resilient water supply system, think about what innovations and systems you can design to help your water supply system withstand a specific threat or stressor.

Remember your city exists at least 100 years in the future. Your engineering solutions should reflect this and be innovative, futuristic, and scientifically plausible.

Today's Water Supply Systems

Below are questions to help you start your research and consider how to make your future city resilient. As you learn about today's water supply systems, look for innovations that engineers and others are developing that you may want to use in your future city.

KEY TERMS

You may find it helpful to know these terms as you are doing your research.

Backup Plan: A set of steps for proceeding when things are not going normally or as expected

Flexibility: Capable of change or modification without losing function

Redundancy: The use of duplicate or overlapping systems in case a part of the system fails

Resilience: In the case of cities, the capacity of individuals, communities, and systems to adapt, survive, and grow in the face of stress and shocks

Risk: A chance of loss or injury

Stressor: In the case of cities, a situation or change that would make current systems vulnerable to failure and affect the health and wellbeing of the people in a city

Vulnerability: The inability of people or systems to withstand the effects of a threat

1. WATER COLLECTION

As a part of the water cycle, water collects naturally on both the surface of the earth and underground. A portion of precipitation (such as rain or melting snow and hail) flows across the earth's surface into creeks, streams, and rivers, and collects in lakes and ponds. Humans may direct surface water into engineered reservoirs to collect it for later use.

Some precipitation also seeps into the soil and down through various layers of rock, and pools in layers called aquifers. To collect this water for human use, wells are drilled down into the aquifers and pumps are used to bring the water up to the surface. Start your research by learning more about how water is collected (and where it comes from) in your own community.

- Investigate different methods of collecting water from its source. How does the city or region where you live collect water?
- What are the sources of the water that comes into your home?
- How many people are served by your city or region's water supply?
- Why do we collect water? It isn't just for drinking and cooking! You may be surprised at how many ways water is used. List as many as you can find.

2. WATER STORAGE

To ensure a steady supply of water throughout the seasons, it's necessary to store large amounts of water. Engineers call this phase raw water storage, because the water hasn't undergone treatment yet. Sometimes the surface catchment itself—a lake, for example—can act as a form of storage. Often water is stored in engineered reservoirs and storage tanks. Dams can be used to create massive reservoirs of water by preventing water from flowing out of a river or valley. In some places, aqueducts and canals are used as an efficient way to move water from raw storage.

- How much water does your city need every day?
- How has your city determined how much water needs to be stored?
- Where are the closest dams to your city? What is their water source? How much water do they store?
- Research reservoirs near your city. Sometimes they are sources of recreation. What activities are allowed at reservoirs near you? Which activities are not permitted at reservoirs near you and why?
- List methods of storing water. How much water is stored for your city? How does storage change seasonally?

CLEAN WATER: TAP INTO TOMORROW RESOURCES

Start your research with a suggested set of websites, books, and videos. Download the list at futurecity.org/resources (filter for Research Resources & Websites).

3. WATER TREATMENT

Water treatment processes vary a great deal, depending on local conditions and standards. In general, water must be cleaned of debris, sediment (sand and silt), particulates, microorganisms (bacteria and viruses), and dissolved compounds. The treatments include both physical methods like filtration and chemical methods like chlorination. Sometimes water is treated with additives to enhance taste, prevent cavities, or prevent pipe corrosion. Only water that meets strict standards for clarity, disinfection, and purity is ready to be distributed to homes and businesses.

- Find descriptions of various water treatment processes. How are they similar and different? What are some of the main options available to water utilities?
- What does your city's treatment plant use to disinfect water?
- Does your city add fluoride to the water? What are the benefits and risks of this additive?

4. TRANSPORT

Water needs to be moved from storage to treatment facilities to the people who use it. Treated water also has to be stored somewhere while it is waiting to be used. This type of storage is called finished water storage (as opposed to raw water storage). More commonly, a complex set of pumps and pipelines are used to transport water, within which maintaining the right pressure level is key to keeping water in motion without creating leaks or bursts. Maintaining the right pressure is also important for firefighting, because firefighters count on a minimum pressure at the hydrant to effectively extinguish fires.

- How is water transported by your regional water utility?
- How will your city monitor pipes for leakage, to make sure no water is wasted?
- How are water pipelines vulnerable to stressors or challenges?
- What materials are the pipes made from? How do these materials ensure there are no long-term effects on the water and that the pipes can withstand a range of stressors?

5. MONITORING

Monitoring the quality of drinking water throughout the world is essential. The Environmental Protection Agency has established national requirements that all potable water in the US must meet. Every water treatment plant tests its water regularly to make sure it is safe to drink. In Canada, water quality is measured according to its *Guidelines for Canadian Drinking Water Quality.*

Every country has its own monitoring system. For example, Egypt has the Egyptian drinking water quality standards. They are used for monitoring the water of the Nile River, the most important source of fresh water in Egypt. Many stressors on water quality have to be measured, such as water flowing into the Nile from drains that carry return flows from farms (which has fertilizer, pesticides, and sewage from animals in it).

Drinking water in China comes mostly from wells that bring up groundwater. In 2018, engineers set up more than 10,000 monitoring wells to gauge the quality of this water—however, they will need more to keep up with the demand.

- Find a recent annual water quality report for your city or region online. What does it say about the quality of your water?
- What are some substances that can show up in tests of our drinking water?
- What diseases does disinfecting our water protect us from?
- If a family gets its water from a private well, how do they make sure the water stays safe to drink?

- How will your city decide which tests to run and which pollutants to test for?
- Who will do the testing in your future city—a city employee, consultant test firm, chemist, engineer, or technician? Will the test be double checked by someone else for quality control?

6. DEMANDS ON OUR WATER SYSTEMS

Maintaining a continuous, reliable supply of water has become more difficult as populations grow, demand increases… and the sources do not. Besides these issues, there are special circumstances that stress our water systems. What if there's a major fire that requires huge quantities of water to put out? What if there's a drought? What if there's a leak or a break in a main pipe that isn't detected? What if there's a chemical spill that enters the water at its source? Engineers think carefully about these possibilities. They also plan water systems that serve communities as they grow.

- How has the population of your city changed over the past 20 years? What changes are planned to handle increased water demand in your city?
- Is a shortage of water an issue where you live? If so, what measures has the city or region taken to conserve water? For example, some cities irrigate parks with gray water, which is water reclaimed from sinks, showers, and washing machines (not toilets).
- What are some ways that city residents can conserve water?

7. EFFECTS OF THREATS ON THE DRINKING WATER SUPPLY

Explore a range of potential issues before selecting one that could affect your future city's drinking water. Remember to choose a problem that could really happen in your future city's geographic location.

- What issues have occurred in the past where your future city is located?
- How might the problem you are focusing on affect each element of your city's water supply system—the source, the storage, the treatment plant, and the methods of getting water into your city's homes and businesses?
- What solutions have engineers come up with - in the past as well as in the present - to maintain water supply systems?
- Does your city have a disaster plan in case of serious water problems? For example, can the city tap another source, get water from a nearby city, or transport in bottled water? Would your city ration water if necessary?
- What are some ancient water supply systems? How have they withstood the tests of weather, threats, and time?

Clean Water: Tap Into Tomorrow: Real-World Case Studies

Case Study: Cape Town

Four million people live in Cape Town, South Africa. Their water supply comes from rain, which is collected and stored in six reservoirs scattered around the city. But a drought that began in 2015 has created a serious water shortage; in 2018, reservoirs only held one fifth of their capacity. Residents live in dread of "Day Zero," when the reservoirs will run dry and fresh water will stop flowing from taps.

Day Zero has been postponed several times as Cape Town institutes measures to make water last longer. The city has repaired leaky pipes. It has also lowered water pressure in pipes, so that less water comes out when people turn on their faucets. Each person is only allowed 13 gallons of water a day—the amount that an older toilet uses for three or four flushes—and fines are imposed when this limit is exceeded. Nobody hoses down the sidewalk or washes their car any more. Farmers also have water restrictions that are 60% less than in pre-drought days. Once a farm hits its limit, their water is simply cut off.

With droughts becoming more common and more severe, water conservation can't solve all of Cape Town's problems. And even in non-drought years, residents will have to practice water conservation. Cape Town has an online "water dashboard" that shows residents the level of water in the reservoirs and how much water they should be using. This kind of information helps most people make necessary changes to their behavior. Those who continue to use too much water receive letters from the city and are warned that water-restricting devices will be installed if necessary.

1 https://www.abc.net.au/news/2018-11-11/drought-put-cape-town-on-a-countdown-to-day-zero/10477538)

Case Study: Fog Water Harvesting

About five inches of rain a year falls on Mount Boutmezguida in southern Morocco. People living in the region used to subsist on the rainwater they captured in cisterns or pulled up from wells, but drought cycles have become more frequent. The wells and cisterns are drying up.

Although the region has so little rain, it does have another potential source of water. Heavy swathes of fog roll in from the Atlantic Ocean and cover Mount Boutmezguida. Fog is a low-lying cloud composed of water droplets. Engineers have figured out a simple, cost effective way to capture these droplets: wind pushes the fog against giant nets to which the water droplets cling, gather, and slide down into troughs. The troughs connect to pipes and the clean water goes straight into people's houses.

The first fog-harvesting nets failed. They ripped apart in the high mountain winds, which often reach 75 miles an hour. Engineers tested a number of prototype fabrics to find one that could resist these winds and be economical, food-safe, and UV-resistant. A 3D mesh system turns out to work best. The nets are easy to take care of too; a wrench and a socket wrench are all the villagers need to keep them functioning well. As of 2018, Mount Boutmezguida has the biggest fog-harvesting system in the world, and 800 homes receive 18 liters of water a day—up from the 8 liters of rainwater per family that used to be painstakingly collected.

Case Study: SmartBall Technology

Leaky pipes lose billions of gallons of water every year, all over the world. Finding those leaks has always been a challenge; water pipes are often many feet below the ground, traveling for miles beneath streets and sandwiched between other pipes and cables. Unless the leak is unmistakable, as in when a water main bursts and a fountain of water suddenly erupts, leaks can seep water for years without detection.

A new technology called a SmartBall can now find these leaks three or four times more effectively than other tools. The SmartBall looks a little bit like a bowling ball. It contains a hydrophone—a microphone designed to listen to sounds underwater. It can find extremely small leaks no matter how big the pipe or what materials the pipe is constructed from, and it provides data about the exact location of the leak. The SmartBall also contains a magnetometer that keeps the ball rolling through the pipe. It is encased in foam so that its own noises don't interfere with detecting the sounds of leaks.

The SmartBall can inspect pipelines that are 30 miles long, all the while emitting a sound every few seconds so that above-ground sensors know exactly where it is. In 2017 the city of Ottawa in Ontario, Canada used the SmartBall to assess the condition of a critical transmission main. It traveled along the pipeline for a couple of miles before its sensors detected the sound of a leak. The city could excavate at exactly the right spot to fix the leak, instead of expending money and manpower on incorrect guesswork. Now cities throughout North America and the rest of the world are making use of SmartBalls to save water and maintain pipelines.

Case Study: Nevada

Nevada relies on the Colorado River for its water; the Colorado River relies on snowmelt from the Rocky Mountains to keep it flowing. But the Colorado River Basin has been in a drought for 19 years. The reservoirs formed by dams along the river—Lake Mead and Lake Powell are the biggest—are at concerningly low levels. The region is expected to get even drier as climate change continues.

Six other states also depend on the Colorado River. Nevada, Arizona, and California form what is known as the lower basin, while Colorado, New Mexico, Utah, and Wyoming are in the upper basin. These states must work together and make sacrifices to avoid triggering mandatory water restrictions set by the federal government. In 2019, these states negotiated a deal to conserve water that includes drought contingency plans (DCPs) for each state. This plan will be in effect through 2026. Through a series of complex regulations that have been hashed out despite political disagreements, Lower basin states have agreed to stop taking water from Lake Mead if it hits a dangerously low level, and to take less from it to prevent this degree of depletion. These states are also implementing water conservation efforts, with saved water being stored in Lake Mead.

The seven states "bank" water that has been saved via conservation to use as needed. Nevada just completed a new water intake system that can reach water at lower levels in Lake Mead. It is also building a new pumping station at Lake Mead to preserve access to Colorado River water for the southern part of the state. Specific conservation methods include recycling wastewater for irrigating golf courses and parks; some water is recycled and returned to the Colorado River. Groundwater is being tapped in addition to river water, although how much and how fast to use it are topics of debate. Researchers are investigating the possibility of desalination projects with California and Mexico, to make use of seawater and brackish water.

Nevada pays residents to replace lawns, which require a huge amount of water to maintain, with landscaping that is drought tolerant. Residents are only supposed to water their yards on certain days of the week and at certain times of day to minimize water evaporation. Residents also have tiered pricing for their water use. If they use more than a certain amount, the price increases substantially. These incentives have helped people to change their behavior around water.

City Essay: Suggested Outline

Tell your students to ask questions and take notes as you review the competition's suggested essay outline and discuss how they can use it to draft their essay.

Part 1: The Introduction

Briefly introduce your future city by including basic information about it. Include the city's name, how old it is, where it is, and how many people live there.

Part 2: A Closer Look

- Paint a picture of life in your future city, as if you are describing it to someone who has never been there. Share details about:
- The climate and natural features (like rivers, mountains, or a nearby ocean)
- What makes your city appealing to different ages and interests of people?
- The services your city provides (schools, hospitals, fire stations, public transportation)
- What are two examples of your city's resilience? (Be innovative! What's resilient about your city's housing? Transportation? Healthcare?)
- Any innovative or futuristic aspects of your city's infrastructure (such as housing, transportation, energy, pollution control, etc.)

Part 3: Define the Problem

- Describe the threat to your future city's drinking water that your team chose to focus on. Include:
- Describe the threat you chose
- Discuss the immediate challenges that this threat creates and any potential lasting effects on your city and residents
- Explain how the drinking water supply system is likely to be disrupted by this threat. What are the system's vulnerabilities?
- Evaluate the impact to the health and safety of the people in your city, including vulnerable populations (e.g., elderly, young, and/or economically-disadvantaged)

Part 4: Describe Your Solutions

- Here's where you get to describe the innovative design of your future city's water supply system and how you've prepared it to withstand your selected threat or stressor. Be sure to:
- Describe your city's water supply system. Be sure to highlight which aspects are futuristic and innovative, and include water collection, storage, treatment, transport, monitoring, and demands.
- Describe two innovative ways you have prepared your water supply system to withstand your selected threat. Include how these solutions ensure the health and safety of city residents.
- Describe some of the risks connected with using the solutions and how the solutions reduce these risks.
- Discuss the tradeoffs/compromises connected with your water supply system and how your design reduces or eliminates these tradeoffs.
- Explain what types of engineering were involved in designing your resilient city and what kinds of engineers were most helpful.

Part 5: Conclusion

Share why people want to live in your city and what makes it a great place to live. Tie together the potential effects of a specific drinking water issue and the need for a resilient water supply system. Summarize how the design of your water supply system will keep the people in your city safe and healthy.

City Essay Rubric

0	1	2	3
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills less than 50% of requirements.	**Good** Average-Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

I. Introduce City and Define the Problem (15 Points)	0	1	2	3
1. City overview • Basic city information: population, age, location • Characteristics: community and cultural preferences, development, economy, etc.	No description of city.	Underdeveloped description of city.	Clear and developed description of city.	Clear and thoroughly developed description of city.
2. Infrastructure • Types of infrastructure could include housing, transportation, energy, pollution control, etc.	No description of city infrastructure.	Description of one type of city infrastructure.	Clear description of two different types of city infrastructure.	Clear and thorough description of two or more types of city infrastructure.
3. City services • Types of city services could include: education, healthcare, fire, police, etc.	No description of city services.	Description of one type of city services.	Clear description of two different types of city services.	Clear and thorough description of two or more types of city services.
4. City innovations and futuristic elements	No description of innovations and futuristic elements.	Underdeveloped description of innovations and futuristic elements.	Clear and developed description of innovations and futuristic elements.	Clear and thoroughly developed description of innovations and futuristic elements.
5. Innovative ways the city is addressing resiliency in areas beyond the water supply. • Focus areas could be housing, transportation, healthcare, etc.	No description of resiliency plans beyond the water supply.	One underdeveloped example of resiliency planning beyond the water supply.	One clear and developed example of resiliency planning beyond the water supply.	Two or more distinct examples of resiliency planning beyond the water supply. Clearly developed and explained.
II. Specs and Solution (21 Points)	**0**	**1**	**2**	**3**
6. Describe the selected threat to your city's drinking water • Immediate impact of threat and potential long-lasting effects • Realistic threat (based on location or geography) • Vulnerabilities of water supply system • Impact on health and safety of vulnerable population groups	No description of water supply threat or potential impact on city. Or threat is not realistic given the city's location or geography.	Underdeveloped description of water supply threat. Briefly touched on short- and long-term effects on city and impact on vulnerable populations.	Clear and developed description of water supply threat. Clearly describes short- and long-term effects on city (and vulnerable populations) and system vulnerabilities.	Clear and thoroughly developed description of water supply threat. Thoroughly describes short- and long-term effects on city (and vulnerable populations) and system vulnerabilities.

DOWNLOAD THIS RUBRIC at futurecity.org/resources (filter for Rules and Rubrics).

City Essay Rubric

0	1	2	3
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills less than 50% of requirements.	**Good** Average-Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

II. Specs and Solution (21 Points) (Continued)	0	1	2	3
7. Describe the future city's water supply system • Collection, storage, treatment, transport, monitoring, and demands	No discussion.	Underdeveloped description of water supply system.	Clear and developed description of water supply system.	Clear and thoroughly developed description of water supply system.
8. Describe two innovative ways the water supply system can withstand the selected stressor. • Utilizes innovative and futuristic technology	No solutions or discussion of innovative technology.	Description of one or more solutions. Technology not particularly innovative.	Clearly outlines two solutions and innovative technology.	Clear and thorough description of two solutions and innovative technology.
9. Resiliency assessment and plans • Conditions that could cause failure • Ability to identify damage and repair the system	No description.	Limited assessment of conditions and ability to identify damage and repair system.	Clear assessment of conditions and ability to identify damage and repair system.	Clear and thorough assessment of conditions and ability to identify damage and repair system.
10. Describe how solutions keep residents safe and healthy	No description.	Underdeveloped description.	Clear and developed description of how solutions keep residents safe and healthy.	Clear and thoroughly developed description of how solutions keep residents safe and healthy.
11. Risks, tradeoffs & compromises • Benefits, drawbacks, risks • Tradeoffs & compromises	No discussion of benefits, risks, or tradeoffs.	Description of one benefit, risk, or tradeoff.	Description of more than one benefit, risk, or tradeoff.	Description of more than two benefits, risks, or tradeoffs.
12. Engineering disciplines involved and role of 1-2 engineers	Engineering disciplines are not identified.	Description of one engineering discipline or role of one engineer.	Clear description of more than one engineering discipline and role of engineers.	Clear and detailed description of more than one engineering discipline and role of the engineers.
III. Judge Assessment of Solutions (12 Points)	**0**	**1**	**2**	**3**
13. Effectiveness and quality of solutions • Effective solutions for maintaining reliable supply of clean drinking water despite threat • Appropriate design and application of technology • Ensures citizen safety and health	Not effective.	One somewhat effective solution. Technology and design need improvement. Questionable ability to ensure citizen safety and health.	Two effective solutions, but technology and design could be improved; good ability to ensure citizen safety and health.	Two highly effective solutions, with excellent technology application; excellent ability to ensure citizen safety and health.

CONTINUED ON NEXT PAGE

City Essay Rubric

0	1	2	3
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills less than 50% of requirements.	**Good** Average-Above average quality. Fulfills at least 85% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements with additional distinctive features.

III. Judge Assessment of Solutions (12 Points) (Continued)	0	1	2	3
14. Innovative and futuristic solutions • Reasonable extrapolation and application of technology • Degree to which solutions involve engineering	Not innovative or original.	Somewhat original or innovative. Not futuristic. Little engineering involved.	Solutions are moderately innovative, original or futuristic. Some engineering involved.	Solutions are highly innovative, original and futuristic. Extensive engineering involved.
15. Plausibility of solutions • Based on sound scientific principles	Implausible or not scientifically sound.	Solutions are not very plausible (science fiction).	Solutions are plausible.	Solutions are highly plausible and scientifically sound.
16. Tradeoffs & compromises • Accounting for risks, benefits • Assessing consequences and making logical decisions	Does not explore tradeoffs.	Some consideration of tradeoffs, but ignores major issues.	Adequate assessment of tradeoffs. Analysis and decisions could be improved.	Excellent assessment of risk, benefits, tradeoffs in decision-making process.
IV. Writing Skills (12 Points)	**0**	**1**	**2**	**3**
17. Organization	Poorly organized	Fair organization	Good organization	
18. Writing skills	Poor writing	Fair writing	Good writing	
19. Grammar & spelling	Many errors	Some errors	Few, if any, errors	
20. Maximum number of graphics • If used, max of 4 (does not include tables)	Exceeds maximum of 4 graphics, illustrations		Does not exceed maximum of 4 graphics and/or illustrations	
21. List of references • At least three acceptable references • Wikipedia is not recognized as an acceptable reference	No references	Less than three acceptable references	At least three acceptable references	
22. Word count • All words except the title and reference list are included in the word count. Word count includes captions and words in graphics, illustrations, and tables.	No word count at end of document or inaccurate count		Accurate word count at end of document	

DELIVERABLE #4:

City Model

70 POINTS
DUE:
DAY OF REGIONAL COMPETITION

Students build a physical model of a section of their city using recycled materials. In addition to showcasing their city of the future, the City Model must also show the team's solution to this year's challenge. The model must have at least one moving part, be built to scale, and may not exceed the $100 expense budget.

Explain to students that engineers, architects, scientists, and city planners all use models to help them communicate their ideas, share their research, and predict the success of their design. Emphasize that the ideas represented in their City Model should be in alignment with their City Essay and reflect what they learned as they designed their Virtual City. Students must decide upon an area of their city that will best showcase their solution to this year's challenge as well as the overall vision they have for their city.

Collect Recycled Materials

Remind students that they only have a $100 budget and need to think creatively about their building and presentation materials.

- Flea markets and garage sales are excellent sources for old toys, bottles, tins, and buttons.
- Old toys, such as Lego pieces, gears, Tinker Toys, and blocks, are excellent materials.
- Builders and plumbers may have discarded pieces of pipe, wire, and wood.
- Home improvement companies and remodelers may be willing to part with obsolete materials from houses they are remodeling. Old parts from stoves, cabinets, and plumbing fixtures may be sources for moving parts or may provide unusual shapes for your buildings.
- Obsolete or outdated electronic equipment may be reused and can provide visual interest in your city.

Note: All of these items have value and need to be listed on the Competition Expense Form.

TRANSPORTING YOUR MODEL

Start thinking about how you will transport your model to the regional competition. Think about how to create a sturdy base and ways to protect the model while it is being moved.

City Model Requirements

- Must be built to scale as determined by the team.
- Must be no bigger than 20" high, 50" long, and 25" wide. During the presentation, it is permissible to have extended parts, such as access doors, compartments, and hinged pullouts, as long as they are fully self-supported by the model, or – if removable – held by a presenter.
- Vertical-oriented models are not accepted.
- Must contain one or more moving part(s).
- Any electrical power must be self-contained (e.g., a household battery or simple circuit). Use of floor or wall outlets is not allowed.
- Use of live animals, perishable items, or hazardous items (e.g., dry ice, fire, flying objects) are not allowed.
- Use of audio or sound is not allowed as part of the model.
- Although a small number of individual pieces from previous competition models may be reused, models must be a new representation of a future city and built from the bare baseboard up.
- The total value of the materials used in the model, as well as those used in support of the presentation and special awards (including color copying/printing, three-dimensional printing, visual aids, costumes, and other demonstration aids) may not exceed $100 and must be reported on the Competition Expense Form.
- A City Model Identification Card must be included on your model. This 4" x 6" index card is used by the judges to identify your team's information. The card should include:
  - City name (has to be the same as the team's name)
  - Scale used for the model
  - School/Organization name
  - Names of the three presenting students, educator, and mentor.

REVIEW THE COMPETITION EXPENSE FORM

Students must list the costs of all items used for their model, presentation, and special awards. Common recycled materials, such as plastic tubs and glass jars may be assigned a zero cost value. Other used, donated, or borrowed items must be assigned a fair market or salvaged value, which may be determined by pricing found at a yard sale, auction, classified ad, or surplus store, for example. For more details, see the Competition Expense form instructions in Appendix: Competition Information and download the form at futurecity.org/resources (filter for Competition Forms & Project Plan).

City Model Resources

Use the following resources to help your students create their City Model.

- **City Design: Questions to Consider:** This student handout helps students focus as they design their cities. See page 59.
- **Build Your City Model:** This student handout includes practical tips for building city models. See page 73.
- **Model-building activities:** Give students plenty of practice by having them do these activities: What Is a Model?, Plan-Relief and Architectural Models, and Building Strong, all at futurecity.org/resources (filter for Activities & Background Info).
- **Building Scale Models:** Students also need practice working with scale. These activities will build students' understanding: Introduction to Scale; Plan and Elevation View; Proportions, Ratios, and Scale Drawings; and Scale Map are all at at futurecity.org/resources (filter for Activities & Background Info) .
- **Moving Part video:** Give students ideas for what moving part to include in their City Model by showing them this video at futurecity.org/resources (filter for Webinars & Videos).
- **City Model Rubric:** Remind students to check their model against the criteria that the judges will use to evaluate their work. See page 75 or futurecity.org/resources (filter for Rules & Rubrics).
- **City Model Video Tutorial:** This video at futurecity.org/resources (filter for Webinars & Videos) helps students understand how to create their model.
- **Examples of other City Models:** Having previous examples to examine can give students lots of ideas. See them at futurecity.org/gallery.
- **Final competition checklist** on page 84.

Competition Scoring

Teams can earn up to 70 points for their City Model. Make sure students have thoroughly covered these categories in the rubric to maximize points:

City Design	20 points
Build It: Quality & Scale	15 points
Build It: Materials & Moving Part(s)	15 points
Judge Assessment of Model	20 points
Total	**70 points**

Scoring Deductions

1–5 points	Remember your City Model Identification Index Card and proofread it to make sure it includes all of the required information.
5 points	Not including your receipts with your Competition Expense Form will result in losing points.
15 points	A missing, incomplete, or inaccurate Competition Expense Form will lose points.
15 points	Models that exceed the competition's stated model dimensions of 20" high, 50" long, and 25"wide will lose points.
15 points	There is a budget of only $100 for the city model and presentation materials, and special awards combined.

Build Your City Model

Questions to Consider

- What scale works best for your model?
- What recycled materials could you use? How could you use them in creative ways?
- If there was funding for only 20 buildings, which buildings would city planners be sure to construct first?
- Buildings are one of the most visible parts of a city. Where are the hospitals? Are there retail centers? Where are the residences? Are there colleges? What about government buildings?
- Identify the infrastructure. How are roads and highways connected? Where are the energy production facilities? Do the water delivery systems and waste management systems have water treatment plants?
- How will you incorporate this year's resilient water supply system challenge into your city model?
- What makes your city innovative and futuristic? How can you show your futuristic ideas are based on science and engineering?
- What will the moving part(s) do? How is it related to an aspect of your city's design or function?
- How will the moving part be powered? Can you easily repeat the movement?
- How can the engineering design process help you build your model?

Tips for Creating the City Model

- Check out the Gallery at futurecity.org/gallery to see models from past competitions.
- Pick an area of the city that best showcases the competition criteria and your concept for the city. The model should highlight the thought process behind the city.
- Remember to choose a scale that works best for your city design. The team members decide the scale based on their design. They will need to create a scale key, such as 1 inch = 5 feet.
- Be sure your model includes a physical representation of your team's solution to the resilient water supply system challenge.
- Remember to add at least one moving part. Designing your own moving part, or creatively modifying an existing item, will earn more points than using a prefabricated or purchased item. The moving part is an excellent opportunity to explore the physics of simple sources of power, such as rubber bands, weights, heat, springs, pulleys, simple circuitry, light and/or solar power.
- Think about how you will transport your model to the regional competition. Ask yourselves:
  - How will we protect the model while we are moving it?
  - What materials will we use to protect the model?
  - How much thickness and bulk will the packaging materials add to the model?
  - Does it weigh more than 75 pounds? If our team advances to the Finals, models cannot exceed 75 pounds.
- Create a solid base for your model by using plywood or particle board. You want to save on weight, but your base has to be stiff enough to carry the model without flexing.

SCALE MEASUREMENTS

Consider a scale that works for both large items, such as buildings, as well as smaller items, such as windows within buildings and traffic signs. These measurements below can be used as a general guide for scaling basic city features. Research dimensions for other features that you plan to include in the model.

12 feet	Width of traffic lane
8 feet	Height of stop sign
10 feet	Height of a building story
4 feet	Minimum width of residential sidewalk

Model Enhancement Ideas

- Trees: These can be made from twigs and sticks with cotton balls (can be painted green), lichen from a hobby store, dried flowers or weeds, or sponges with food coloring.
- People: These can be made from sticks, toothpicks, mat board, pins, dowels, pipe cleaners, and so on.
- Cars: These can be made from layers of mat board or cardboard glued together, toy cars that are the right scale, Styrofoam, and so on.
- Glass: You can use clear plastic dividers, sleeves, or sheets. Remember to put this on last so that it doesn't get scratched.
- Bricks/Pavers: You can use colored paper or other colored material that matches what you want it to look like and then draw on the pattern or you can take white paper or material and color it with markers, crayons, or similar, remembering to show the pattern.
- Asphalt: You can take black paper or color white paper black and then draw on the lane markers with a white and/or yellow colored pencil or crayon and then cut to size.
- Cement: You can use gray paper or color white paper and then cut to size.
- Grade changes: You can use Styrofoam that is cut/shaped to what you want and use layers of cardboard or mat board to form contours or slope the model.
- Water: You can use blue colored paper or color white paper blue. For added affect, you can put clear plastic or plastic wrap (the kind you use for foods) over it.
- Building material look: To make something look realistic, you can draw on joint lines.
- Sand/beach: You can use sand paper (very fine grit).
- Grass: Use green colored paper or color white paper green, green felt or fabric, or you can use a grass material from a hobby store.

MOVING PART MECHANISMS

Your moving part must be able to have the motion repeated and must be related to a function of the city or your resilient water supply solution. Ideas for moving part mechanisms include:

- Rubber bands
- Heat
- Light/Solar
- Weights
- Springs
- Pulleys
- Batteries
- Simple circuitry

Creatively engineered or innovatively modified moving parts garner more points. For example: a store bought, electric, hand-held fan that is glued to a model is technically a moving part, but it will not receive as many points as a moving part whose team put time, effort, and engineering thought into its construction or development.

City Model Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–Average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

I. City Design (20 Points)	0	1	2	3	4	5
1. City representation • Includes all zones: residential, commercial, industrial • Clearly recognizable elements, identifiable structures, zones	No evidence of zoning. No variety of structures.	Zoning unclear. Little variety of structures.	At least one zone; small variety of structures.	One or two zones, some variety of structures.	Two or more zones and some variety of structures. Could be more comprehensive.	All three zones; excellent variety of recognizable structures.
2. City infrastructure and services • Includes essential infrastructure (water, roadways, power, utilities, etc.) • Includes variety of essential city services (public safety, health, education, etc.)	No infrastructure or services.	Shows very little infrastructure and services.	Few infrastructure or service components.	Some infrastructure and services. Not all essential to city operation.	Several infrastructure and services. Not all essential to city operation.	Several comprehensive infrastructure and services essential to city operation.
3. Interconnectivity within city • Interconnectivity of zones and infrastructure • Transportation modes: pedestrian, public, goods and services	No interconnectivity.	Little interconnectivity.	Some interconnectivity, but some awkward design. Few transportation modes shown.	Adequate interconnectivity and transportation modes.	Very good interconnectivity and illustration of transportation modes.	Excellent interconnectivity of zones and illustration of transportation modes.
4. Model demonstrates theme: Clean Water: Tap Into Tomorrow • Essay topic/theme incorporated into model • Shows solutions for challenge	No illustration of problem or solutions.	Little illustration of problem or solutions.	Some illustration of problem and attempt at solutions.	Fairly clear illustration of solutions for theme topic.	Clear illustration of solutions for the problem presented by theme.	Clear and thorough illustration and solutions for problem presented by theme.
II. Build It: Quality & Scale (15 Points)	**0**	**1**	**2**	**3**	**4**	**5**
5. Quality workmanship and age appropriateness • Age appropriate for 6th, 7th, 8th grades • Quality construction • Reasonably durable	Poor quality.	Mediocre quality.	Fair to good quality.	Good quality. Age appropriate.	Very good quality. Age appropriate.	Excellent quality. Age appropriate.

CONTINUED ON NEXT PAGE

DOWNLOAD THIS RUBRIC at futurecity.org/resources (filter for Rules and Rubrics).

City Model Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–Average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

II. Build It: Quality & Scale (15 Points) (Continued)	0	1	2	3	4	5
6. Appearance • Use of color, graphics, shapes, etc. • Realistic elements (flora, fauna, landscapes)	No aesthetics.	Poor aesthetics.	Fair aesthetics.	Good aesthetics that enhance the model.	Very good aesthetics that enhance the model.	Excellent and realistic aesthetics that enhance the model.
7. Model scale: _____ • Appropriate scale chosen to create a good city model • Two scales may be used as long as they are clearly defined, easily determined by sight, and indicated on the team's Model Identification index card • Applied horizontally and vertically	Scale not used.	Inconsistent scale for majority of model.	Fair scale choice. Some scale inconsistencies.	Good scale choice; city elements easy to identify. Scale(s) consistently applied.	Very good scale choice; city elements easy to identify. Consistent application of scale(s).	Excellent scale choice; city elements very easy to identify. Consistent application of scale(s).
III. Build It: Materials and Moving Parts (15 Points)	0	1	2	3	4	5
8. Innovative construction materials, techniques • Variety of materials, imaginative or unusual materials • Creative modification and application of recycled materials • Building materials are primarily recyclable	No creativity or innovation.	Few recycled materials. Very few creative materials or materials used without modifications.	Recycled materials. Little creativity, variety. Little attempt to modify.	Recycled materials. Some variety of innovative materials. Some creatively modified recycled materials.	Recycled materials. Good variety of innovative materials. Many creative modifications and applications.	Recycled materials. Exceptionally varied and innovative. Most creatively modified and applied.
9. Moving part innovation and quality • At least one moving part • Quality workmanship, durability • Repeatability of movement • Innovative execution and creative engineering	No moving part.	One moving part. Fair quality. One time movement. Minimum engineering or modification to a purchased moving part.	One moving part. Good quality. Little innovation. Little engineering or modification to a purchased moving part.	At least one moving part. Good quality. Repeatable movement. Somewhat innovative.	At least one moving part. Very good quality. Repeatable movement. Innovative.	More than one moving part. Excellent quality. Repeatable movement. Highly innovative.

City Model Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–Average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

III. Build It (Continued)	0	1	2	3	4	5
10. Moving part • At least one moving part • Related to design or function of city	No moving part.	Moving part cosmetic; not relevant to city function.	Moving part not relevant to city function.	At least one moving part somewhat related to city function.	At least one moving part intrinsic to city function.	More than one moving part essential to city function.
IV. Judge Assessment of Model (20 Points)	**0**	**1**	**2**	**3**	**4**	**5**
11. City Design • Well planned. Considers livability concepts: – Neighborhoods, green spaces, mixed zones – Interconnectivity – Sustainable – Accessibility	No planning.	Little planning. Very little consideration of livability concepts.	Some planning is obvious. A few livability elements included.	Planned design. Incorporates some livability concepts.	Well-planned design. Incorporates several livability elements.	Clear and thorough planning and design. Highly livable.
12. Innovative systems • Creative design of city services and systems (transportation, waste management, recreation, etc) • Technologically plausible	No systems.	Underdeveloped design of city services and systems. Not technologically plausible.	Fair design of city services and systems. Could be more creative. Technology is somewhat plausible.	Creative and moderately developed design of city services and systems. Technology is somewhat plausible.	Creative and clearly developed design of city services and systems. Technology is plausible.	Very creative and thoroughly developed design of city services and systems. Technology is plausible.
13. Application of futuristic, advanced technologies • Includes futuristic technologies, components, infrastructure • Plausible extrapolations of scientific advancements	No futuristic examples.	One or two futuristic examples. Artistic, but not technologically or scientifically sound.	Few futuristic examples. At least one technologically or scientifically sound.	Some futuristic examples, most of which are technologically and scientifically sound.	Several futuristic examples, many of which are technologically and scientifically sound.	Highly futuristic and based on sound technological and scientific principles.
14. Model effectiveness • Functions as stand-alone representation of city design • Function and purpose of model elements and relationship to each other is evident on visual examination	No effective representation.	Fair representation of a city. But for many elements, one asks "What is this and why is it here?"	Good representation of a city, however the function and purpose of many of the elements is not evident.	Good visual representation of a city, but purpose/ function of some elements not evident.	Very good visual representation of a city. A few elements not obvious.	Extremely effective visual representation of a future city. Function and purpose of elements easy to understand.

DELIVERABLE #5:

City Presentation

70 POINTS
DUE:
DAY OF REGIONAL COMPETITION

Students give a 7-minute presentation discussing features of their future city and their solution to the annual challenge followed by a question and answer period of 5–8 minutes from the judges. Check with your Regional Coordinator for exact competition time limits.

Engineers communicate with a variety of professionals every day. Being able to talk about their ideas and solutions clearly and succinctly is a very important skill that engineers and technical professionals use throughout their careers. For this deliverable, students develop these communication skills by creating and delivering a presentation that describes their future city and their innovative solutions to the resilient water supply challenge.

City Presentation Requirements

- **Time allowed:** The presentation can be up to 7 minutes, followed by a question and answer period of 5–8 minutes.
- **Use visual aids and props.** While the model is the primary demonstration aid, students may use pointers, display boards, flip charts, costumes, handouts, and brochures during the presentation. With the exception of a handout and costumes, any visible item that is not part of the City Model will be deemed a visual aid and subject to the following size limitations:
  - *Display boards*—Visual aids, such as flip charts, foam boards, poster boards, etc. must not exceed these parameters: the display(s) cannot be larger than standard size (24" x 36" for poster boards, 25"x 30" for flip charts, 36" x 48" for tri-fold boards); up to two poster boards or flip charts may be displayed concurrently, or one tri-fold at one time. Note: signs created with a matte finish look better in photographs..
  - *Flip Charts*—If you are using prepared flip charts, make sure your writing does not show through to the next page. Make your lettering BIG AND DARK. (Use blue, black, brown, purple, or dark green markers.)
  - *Costumes*—Includes anything the presenters wear or carry that enhances the role they are depicting in their presentation (e.g., team t-shirts, cell phones, briefcases).
  - *One handout and small mock-ups*—All items in this category must collectively fit within a 6" x 6" x 12" volume (e.g., a shoe box).
  - *One brochure*—This is limited to one 8.5" x 11" sheet of paper.
- **Expense Limit: Stay within $100.** The total value of ALL the materials used in support of the presentation and special awards, including the city model and costumes, may not exceed $100. All materials must be documented on the Competition Expense Form found at futurecity.org/resources (filter for Competition Forms & Project Plan.)
- **Audiovisual equipment:** Audiovisual equipment, including laptop computers, overhead projectors, DVD/video players, iPods, iPads, and mp3 players, is not allowed.

City Presentation Resources

Use these resources to help students create their presentations and practice them.

- **Practice Questions:** Students can get a sense of the kinds of questions the judges may ask. Available in late October, download at futurecity.org/resources (filter for Handbook & Student Handouts.)
- **Videos of Presentations:** These videos from past Champions and Runners-up show students what to expect at the competition. They are found online at futurecity.org/gallery.
- **Competition Forms:** Parents or guardians of students must complete the online media waiver form before the Regional Competition. Honor Statements and Competition Expense Forms may be uploadable online, or you may be expected to bring them in person on the day of the competition. For details, check with your Regional Coordinator. All these forms can be found at futurecity.org/resources (filter for Competition Forms & Project Plan).
- **Final Competition Checklist** on page 84.

Competition Scoring

Teams can earn up to 70 points for their City Presentation. Make sure students have thoroughly covered all of these categories in the rubric to maximize points:

Content & Delivery	35 points
Engineering and Technology	20 points
Judge Assessment	15 points
Total	**70 points**

Scoring Deductions

15 points	Remember, there is only a $100 budget for the model, presentation materials, and special awards combined.
15 points	Pay attention to the official presentation dimensions (e.g., display sizes).
20 points	Mind your manners, or points will be deducted.

DISQUALIFICATION

Anyone caught destroying another team's model is automatically disqualified.

City Presentation Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor-Fair quality. Fulfills at least 20% of requirements.	**Fair** Fair-Average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

I. Content & Delivery (35 Points)	0	1	2	3	4	5
1. Presentation content, organized • Major elements: intro, body, and conclusion • Logical flow and transitions between elements • Supporting info (definitions, examples, statistics, quotes, etc.) • Concise and relevant	Poorly organized and no major elements addressed.	Poorly organized and missing some major elements. Little relevant information.	Fair organization. Contains most major elements. Some relevant, supporting information. Some transitions.	Contains all major elements. Good transitions. Supporting information could be more relevant and concise. Could develop ideas more thoroughly.	Well organized, creative, and contains all major elements. Supporting info is relevant, concise, but could be more thorough.	Extremely well organized and creative. Excellent variety of effective supporting information provides credibility. Concise and relevant.
2. Overall city design & features • City features, benefits, and aesthetics • Geography, demographics or distinctive characteristics • Unique infrastructure and services (e.g., transportation, energy, waste or pollution control)	No description of city.	Very brief or incomplete description of the city. Few benefits or innovations discussed. Little explanation or not believable.	Fair description of the city. Some distinctive benefits and innovations explained. Somewhat futuristic and believable.	Average description of the city. Many distinctive benefits and innovations explained. Somewhat futuristic and believable.	Clear description of city. Many benefits and innovations explained. Futuristic and believable.	Clear and thorough description of city. Highly innovative technology applied throughout. Explained in detail. Futuristic and believable.
3. Essay topic: Clean Water: Tap Into Tomorrow • Discusses essay topic • Explains how the theme influenced the city design and development	Essay theme not addressed.	Refers to essay briefly; little or no discussion of other program components.	Briefly discusses essay topic and solution. No real supporting facts. Little explanation of how their city design incorporates the theme.	Discusses the essay topic and solution; some supporting facts. Somewhat explains how their city design incorporates the theme.	Discusses the essay topic and solution. Good supporting facts. Clearly explains how their city design incorporates the theme.	Discusses the essay topic and solution with excellent supporting facts. Clear and thorough explanation of how their city design incorporates the theme.

ONLINE **DOWNLOAD THIS RUBRIC** at futurecity.org/resources (filter for Rules and Rubrics).

City Presentation Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–Average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements.	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

I. Content & Delivery (35 Points) (Continued)	0	1	2	3	4	5
4. Presentation skills • Fluent, clear, audible delivery • Correct grammar and appropriate language use • Upright posture with practiced use of visual aids • Overall confident, direct, and animated delivery	Poor skills throughout.	Fair verbal and nonverbal skills displayed by some presenters, but needs more practice to improve in most areas.	Fair to good skills shown by the majority of the presenters.	Good verbal and nonverbal skills exhibited by most presenters; somewhat confident and direct.	Very good verbal and nonverbal skills by most of team throughout most of the presentation.	Excellent verbal and nonverbal skills by the entire team throughout the presentation.
5. Use of model and other demonstration aids • Model is the key element of entire delivery • Additional visual aids, if used (posters, props, costumes, handouts) are neat, well-prepared • All aids enhance, rather than distract, from presentation • Delivery with all visual aids is well practiced and confident	Model not referenced. No other visual aids.	Model is not used effectively. Other demonstration aids poor or non-existent.	Model is partially effective at enhancing the presentation. Other visual aids are fair to good.	Good use of the model as an illustration of city design and function. Other visual aids are effective and generally add to presentation.	Model used effectively to illustrate city design, function and innovations. Other visual aids are very good and enhanced the presentation.	Extremely creative, integrated use of model contributed to the understanding of city design and function and innovations. Other visual aids are excellent.
6. Teamwork during presentation and Q&A • Team members supported each other • Team members shared time equally • Team members displayed an equal amount of knowledge • Full complement of team members (three students)	No evidence of teamwork.	A small amount of collaboration among team members but more support of one another is needed; one or two tend to dominate during both presentation and Q&A.	Some collaboration, some support and sharing among some team members. Amount of knowledge appears unequal. One or two tend to dominate during either presentation or Q&A.	Good collaboration; support and sharing among most members. Full complement of three team members. Some team members have more knowledge and dominate.	Very good collaboration, support and sharing among the team on both Q&A and presentation. Equivalent knowledge level for most of team. Full complement of three team members.	Excellent collaboration, support, and sharing among team members during both presentation and Q&A. All three team members display thorough knowledge.

CONTINUED ON NEXT PAGE

City Presentation Rubric

	0 **No Points** Requirements missing.	1 **Poor** Poor–Fair quality. Fulfills at least 20% of requirements.	2 **Fair** Fair–Average quality. Fulfills at least 50% of requirements.	3 **Good** Average quality. Fulfills at least 85% of requirements.	4 **Very Good** Above average quality. Fulfills 95% of requirements.	5 **Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.
I. Content & Delivery (35 Points) (Continued)	**0**	**1**	**2**	**3**	**4**	**5**
7. Questions and answers • Answers questions with confidence • Accurate, complete answers	Unable to answer questions coherently.	Answers a few questions accurately. No supporting facts.	Students answer at least 50% of the questions accurately; few supporting facts.	Students answer 85% of questions with accuracy and some supporting facts.	Answers 95% of the questions accurately with supporting detail.	Students fully, accurately, and confidently answer all questions with many supporting details.
II. Engineering and Technology (20 Points)	**0**	**1**	**2**	**3**	**4**	**5**
8. Technologies used in city • Innovations in technology and futuristic concepts • Discusses city systems (transportation, waste management, recreation, etc.)	No discussion.	Little discussion of technologies used in city; little innovation.	Some discussion of technology and city systems; little innovation.	Good discussion of technology and city systems; somewhat innovative.	Clear discussion of technology and city systems; innovative.	Clear and thorough discussion of technology and city systems; highly innovative.
9. Engineering design process • Discusses the application of the engineering design process to the Future City project.	No discussion.	Little or no discussion of engineering design process.	Briefly discusses engineering design process.	Discusses engineering design process and application to Future City project.	Clear discussion and understanding of engineering process and application to Future City project.	Clear and thorough discussion and understanding of engineering design process and application to Future City project.
10. Engineering and engineering roles • Demonstrates a knowledge of engineering roles in city design and operation	No mention of engineering roles.	Mentions engineering, but little discussion of roles.	Briefly discusses and shows limited understanding of engineering.	Discusses and shows understanding of engineering.	Clear discussion and understanding of engineering roles.	Clear and thorough discussion and understanding of engineering roles in city design and operation.
11. Tradeoffs • Discusses potential limitations and benefits • Analyzes tradeoffs	No mention of tradeoffs.	Little mention of limitations or benefits. No tradeoffs.	Some discussion of limitations, benefits or tradeoffs.	Good analysis of limitations and benefits. Mentions tradeoffs.	Clear analysis of risks, limitations and benefits and the tradeoffs made.	Clear and thorough analysis of risks, limitations and benefits and the resulting tradeoffs.

City Presentation Rubric

0	1	2	3	4	5
No Points Requirements missing.	**Poor** Poor–Fair quality. Fulfills at least 20% of requirements.	**Fair** Fair–Average quality. Fulfills at least 50% of requirements.	**Good** Average quality. Fulfills at least 85% of requirements.	**Very Good** Above average quality. Fulfills 95% of requirements	**Excellent** Excellent quality. Fulfills 100% of requirements. Additional distinctive features.

III. Judge Assessment Of Knowledge and Understanding (15 Points)	0	1	2	3	4	5
12. Gets It: engineering, technology and innovation • Demonstrates an understanding of technology used in city • Technologies are futuristic, but plausible extrapolations of current state-of-the-art	No understanding or technology. No plausible innovation.	"Buzzwords," but little understanding of technology. Little innovation that is plausible.	Fair understanding of technology. Few plausible innovative solutions.	Good understanding of technology and application to the solution. Some innovative solutions and plausible technological advancements.	Clear understanding of technology. Innovative and advanced technological solutions that are plausible.	Clear and thorough understanding of the technologies used. Solutions are innovative and advanced technologies are plausible.
13. Gets It: city design and requirements • Demonstrates an understanding of city issues, requirements and operation • Excellence in city design	No city design or understanding of issues.	Overall city design is lacking. Little understanding of issues.	Overall city design is fair. Some understanding of issues.	Overall city design is good. Good understanding of issues driving city requirements.	Overall city design is very good. Clear understanding of issues and requirements is reflected in design.	Excellent city design shows clear and thorough understanding of issues and requirements that influenced decisions.
14. Gets It: Future City and design process • Understands the integration of the Future City process from initial design, virtual city, research, model and presentation • Applies lessons learned from various phases of Future City project to solution	No understanding.	Demonstrated little understanding of the Future City design processes.	Fair understanding of Future City design process. Little indication that lessons from early testing and research used in final design.	Good understanding of Future City design process. Some application of knowledge to final city.	Clear understanding of Future City design process. Evidence that knowledge gained in various stages applied to final city.	Clear and thorough understanding of Future City design process. Final city builds on knowledge gained throughout the project.

Final Checklists

These checklists are in order of when deliverables are typically due. Make sure you have the correct due date from your educator or mentor for each deliverable.

Virtual City

- ☐ Your Virtual City must have the same name as your team. Pick one that is meaningful and unique! The city/team name will appear on all team deliverables and must not change during the competition.
- ☐ Check the number of slides. It cannot exceed 23 slides.
- ☐ Convert the slideshow to a PDF document before uploading.
- ☐ Upload your Virtual City slideshow at the online submission center at www.futurecity.org.

City Essay Checklist

- ☐ Include the name of your city on each page of your City Essay. Remember that the name of your future city needs to remain the same throughout the competition.
- ☐ Check the word count: 1,500 words is the maximum number allowed. Word count does not include the title and reference list but does include captions and words that appear within a graphic, illustration, or table.
- ☐ Count the graphics. A maximum of four graphics/illustrations are allowed.
- ☐ Cite your sources. Use the Modern Language Association (MLA) format.
- ☐ Spell check and grammar check your City Essay.
- ☐ Upload your City Essay as a Word document to the online submission center at futurecity.org.

Project Plan Checklist

- ☐ Make sure all four parts of the Project Plan are in one document, then save it as a PDF, and upload the document to the online submission center at futurecity.org.

City Model Checklist

- ☐ Double check your City Model against the Competition Requirements on page 71.
- ☐ Complete a City Model Identification Index Card. This 4" x 6" index card is used by the judges to identify your team's information. The card should provide:
  - City name
  - Scale used for the model
  - School/Organization name
  - Names of the three presenting students, educator, and mentor.
- ☐ Verify how the model will be transported to the competition. Models may sustain damage in transit. Teams are encouraged to bring repair kits (containing tape, glue, etc.) to reattach or fix any broken parts. The model needs to be sturdy and substantial enough for staff to move during the course of the competition without incurring damage.

City Presentation Checklist

- ☐ Time your presentation. Remember, it can be no longer than 7 minutes. Although there is no penalty for taking less time, the more detailed the information you provide, the higher the potential score.
- ☐ Fill out the Competition Expense Form with all of the materials used to build the model and the presentation/special award materials. Remember that you cannot exceed a combined total of $100.

Regional Competition Checklist

The following items will need to be completed online or brought to the competition. Check with your Regional Coordinator for details:

- ☐ Competition Expense Form
- ☐ Honor Statement
- ☐ Media Waiver Form
- ☐ The City Model Identification Index Card
- ☐ The City Model
- ☐ Any props or costumes for your City Presentation

Competition Rules

Official Competition Rules

General

1. The Future City Competition is open to eligible 6th, 7th, and 8th grade students, who are enrolled in a public, private, parochial, or home school environment, or are members of a nationally, regionally, or state-recognized organization, such as the Scouts, Boys and Girls Clubs, 4-H, etc. If you are not sure if your organization is eligible to participate, please contact info@futurecity.org. Future City has the sole and exclusive authority to determine whether an organization is eligible to participate and has the right to require additional documentation to verify eligibility.
2. Student team members must be from the same school or organization. Students cannot be on multiple teams in the same competition season.
3. Organizations may register in only one region or subregion per year. If they wish to transfer to a different region, they must petition and obtain the approval of the Regional Coordinator and the Program Manager. Teams must commit to a specific region by October 31, 2019.
4. As many students may work on the project as you wish, but only three students can represent your educational institution or organization by giving their team's presentation and answering questions at the Regional Competition and Finals Competition. In addition, one educator (any educational professional) and one mentor (because of the nature of the competition a mentor from the engineering community is preferred, but a mentor can be anyone involved in a technical profession) are recognized as part of the official team of five members but may not participate in the competition presentation or answer questions from judges.
5. The team members that compete in the Finals Competition must be the same team members that won the Regional Competition. At the time of registering your team(s) for the Regional Competition, you may select one student who can act as an alternate for both competitions. The alternate can only be utilized if one of the original three presenters cannot compete due to illness or family emergency. The alternate can only compete upon the approval of the Regional Coordinator (for the Regional Competition) and the Program Manager (for the Finals Competition).
6. At least 20 schools/organizations must be registered in a region by October 31, 2019 in order for that region's winner to advance to the Finals Competition.
7. Home school parents must submit a home school affidavit to their Regional Coordinator stating that the students are covering material in the 6th, 7th, or 8th grades.
8. Deliverable deadlines are set by each region. Contact your Regional Coordinator for specific details. If deadlines are missed at the Regional or Finals level, points will be deducted from the score.
9. At regional competitions, only one team from a school or organization can advance to the final round of judging. At competitions with a single judging round, only one team from a school or organization may be awarded a place in the top five overall teams.
10. Winners of a sub-region's competition will advance to compete at the Regional Competition.
11. All team members must sign the Honor Statement and submit it in accordance with the schedule set by the Regional Coordinator.
12. Judges evaluate each deliverable in accordance with the rubrics. The score a judge assigns is final.
13. Decisions are final. Teams will not receive raw scoresheets or be able to review scores from individual judges.
14. Actions or comments by any team member or any team supporter that maligns, disparages, or harasses other team members, Regional Coordinators, Future City volunteers, or Future City staff will result in the team's disqualification from that year's competition and could result in the school/organization being ineligible to participate in the future.
15. If a dispute or disagreement occurs at the regional level, an official Future City Team Educator shall bring the matter to the attention of the Regional Coordinator. An official Team Educator is the only person who may submit a complaint to the Regional Coordinator. The Regional Coordinator will thereafter conduct an investigation and make a determination regarding the complaint. All decisions by the Regional Coordinator shall be final and cannot be appealed.
16. For the Finals Competition: Each Future City participant is solely and exclusively responsible for health insurance coverage. Future City provides no coverage prior to, during, or following any Future City event and Future City assumes no responsibility or liability in connection with the provision of any health insurance coverage.
17. In the case of a tie at the Regional Competition, the team with the higher presentation score will be awarded first place. If the tie still remains after that, the team with the higher model score will be awarded first place.
18. Educators can see their team's average scores by logging into futurecity.org following the Regional and Finals competitions. Educators may download their team's score information by following instructions at www.futurecity.org/resources before February 28, 2020. After February 28, 2020 scores will be erased from the database.
19. A person who volunteers in the capacity of a judge (at any level) during the competition cycle may not serve as a mentor nor an educator during that same cycle. Nor may they provide guidance, coaching, tips, etc., to any active team member, teacher, engineer mentor, etc., during that same competition cycle. If violated, that judge's scores will be invalidated.
20. If a team is located outside the typical geographical parameters of a region, whether or not they are permitted to participate in said region is at the discretion of the Regional Coordinator.

21. Future City is an educational program established to encourage children to consider and explore careers in science, technology, engineering and math. Future City participants and their supporters acknowledge that participation in Future City is not a right. By participating in the Future City Competition, team members and team supporters agree and are bound to behave with respect and dignity for their team and for their fellow participants.
22. Future City reserves the sole and exclusive right to amend these rules at any time.

Virtual City Design (SimCity)

23. The screenshots taken for the Virtual City deliverable must follow the instructions as stated on page 51 of the Handbook. Sandbox mode in SimCity is not allowed.
24. Cheat codes are discouraged but not forbidden. If used, codes must be referenced in the slideshow according to the deliverable's instructions.
25. The virtual city must be the original work of the team and cannot be copied or cloned from any other individual, team, or group's work.

City Essay

26. Students must submit a reference page citing at least three sources of information with the essay. (Note: Wikipedia cannot be cited as a reference.)
27. The City Essay maximum word count is 1,500 words. Initial tabulation is done by the "word count" tool within the word processing software. The final word count does not include the title and reference list but does include captions and words that appear within a graphic, illustration, or table. A maximum of four graphics or illustrations are allowed. A 10-point penalty will apply if word count exceeds 1,500.
28. The City Essay file must be uploaded as a word processing document, not a PDF.
29. If any part of a team's City Essay is determined to be plagiarized, the team will earn zero points.

City Model

30. Teams must design a new model each year of original work. Teams are not allowed to use previous years' models. However, previous models may be broken down and scavenged for materials including the bare model platform. Any previously-used materials must be reconfigured in a new and original manner and assigned a current market value.
31. If water is used in the model, it must be self-contained or drainable. Prohibited model items: live animals, perishables/food, drones or other flying objects, hazardous items (including dry ice) and fire.
32. The city model in its basic state must fit to be no larger than 25" (W) x 50" (L) x 20" (H). During the presentation, it is permissible to have extended parts, such as access doors, compartments, and hinged pullouts, as long as they are fully self-supported by the model, or – if removable – held by a presenter. Failure to comply with the city model dimensions will result in a 15-point penalty.
33. Vertically oriented city models are not accepted.
34. The city model must contain one or more moving parts.
35. Power sources must be self-contained, (e.g., a household battery/simple circuit). Use of electrical wall or floor outlets are not allowed.
36. The total value of the materials used in the city model, city presentation, and special awards (including visual aids, costumes, color copying/printing, 3D printing, and other demonstration aids) may not exceed $100.
37. All materials used must be listed on the Competition Expense Form and their value documented for the model, presentation, and special awards. This includes donated and borrowed items at fair market value.
38. A team may use two distinct scales if they are clearly defined, easily determined by sight and indicated on their index card. A maximum of two scales may be used.
39. Rotating city models are acceptable. The model will be measured from the tabletop up, including dimensions of any turning device below the model itself.
40. Use of 3D printers for any model materials must be assessed using the following values, which account for the cost of filament and the hardware/printer:
    - Regular (white) 3D printing: $2.00 per cubic inch
    - Color 3D printing: $5.00 per cubic inch
    - All 3D printed materials used – whether new and reused - must be reported on the competition expense form using these values.
41. Programmable circuit boards (ex: Raspberry Pi, Arduino, etc.) are permitted as long as only one is used and the full cost is listed on the expense form. A minimum $35 value is required to be listed for such boards.

City Presentation

42. Regional Competition: Student presentations may not exceed 7 minutes. When the timer signals time, the team must stop their presentation. Question and answer sessions immediately following the presentation will be 5 to 8 minutes, as determined by the Regional Coordinator.
43. Finals Competition: Student presentations may not exceed 7 minutes. When the timer signals time, the team must stop their presentation. Presentations are followed by a 5-minute Q&A session. If the team's presentation is under 7 minutes, the Q&A will be extended until a total time of 12 minutes is reached.
44. Laptop computers, overhead projectors, DVD/video players, battery-operated audio equipment, any mobile devices, and drones may not be used in the presentation.
45. Visual aids, such as flip charts, foam boards, poster boards, etc. must not exceed these parameters: the display(s) cannot be larger than standard size (24" x 36" for poster boards, 25" x 30" for flip charts, 36" x 48" for tri-fold boards); up to two poster boards or flip charts may be displayed concurrently, or one tri-fold at one time.
46. With the exception of a handout/brochure (limited to one 8.5" x 11" sheet of paper) and costumes, any other demonstration aids including pointers, small mock-ups, musical instruments, etc. used to assist with the presentation must collectively fit in a 6" x 6" x 12" volume (e.g., a shoe box).

Scoring Deductions

By completing all five deliverables, teams can earn up to 258 points. Judges evaluate each deliverable in accordance with the rubrics. The score a judge assigns is final. At the Regional Competition, the Regional Coordinator has the final word on any dispute. At the Finals Competition, the judges' decisions are final. There is no appeals process at either level of competition.

Penalty	Item	Description
5–10 points	Missing the submission deadline for Virtual City or City Essay	The Virtual City and City Essay must be received in accordance with deadlines set by the Regional Coordinator. Check with your Regional Coordinator to determine if they accept late submissions.
10 points	Exceeding City Essay word count	Maximum of 1,500 words.
15 points	Exceeding City Model dimensions	The maximum dimensions of the model are 20" high, 50" long, and 25" wide.
15 points	Competition Expense Form is missing	The Competition Expense Form, with receipts attached to the back, must be brought to the competition.
5 points	Receipts missing from back of Competition Expense Form	Receipts must be attached to the back of the Competition Expense Form. Follow instructions on the form.
15 points	Exceeding the $100 limit or misrepresenting the values of materials used in the city model and/or presentation/special awards	The total value of the materials used in the model, as well as those used in support of the presentation and for special awards (including visual aids, costumes, color copying/printing, three-dimensional printing, and other demonstration aids) may not exceed $100.
1–5 points	Missing all or part of the Model ID card	The Model ID card is a 4" x 6" index card with city name, organization name, team members' names (three student presenters, educator, mentor), and scale used.
15 points	Exceeding visual aid display size	Support materials must adhere to the size restrictions listed in the Competition Rules on page 85.
2 points	Missing Honor Statement	A properly filled out Honor Statement Form must be submitted. Follow instructions on the form, available at futurecity.org/resources (filter for Competition Forms).
20 points	Unsportsmanlike conduct	Rude behavior or disruption of judging by any team member or guests.
0 points earned for deliverable	Plagiarism	If a team's City Essay is determined to be plagiarized, the team will earn zero points for the deliverable.
Disqualification	Destruction of another team's model or presentation materials or actions or comments from team members or team supporters that malign, disparage, or harass regional coordinators or volunteers	

QUESTIONS?

Check out the Frequently Asked Questions at futurecity.org.
Don't see your question there? Email your Regional Coordinator or info@futurecity.org.

Prizes and Awards

Future City Competition Finals

Teams that win their Regional Competition* go on to represent their region at the Finals. Finals takes place from February 15 to 19, 2020, in Washington, DC. Future City will provide roundtrip transportation (most economical airfare), hotel accommodations at the Hyatt Regency Washington on Capitol Hill, and two meals for the team's three student presenters, educator, and mentor. All other expenses are the responsibility of the team. **Note:** Students from a mixed gender team may be placed in a room with a student from another team or opt to pay for a single room.

The Future City Competition Finals are generously sponsored by Bechtel Corporation, Bentley Systems, Inc., NCEES, Shell Oil Company, and DiscoverE.

Regional Prizes and Special Awards

Teams that compete are also eligible for a number of special awards. For a complete list of the prizes and awards offered by your region, visit www.futurecity.org and click on Find My Region.

Finals Prizes

The top prize at the Finals is $7,500 for the organization's STEM program and a trip to U.S. Space Camp in Huntsville, AL for up to five people (including an adult chaperone), awarded by Bentley Systems, Inc.

2nd Place is awarded a $5,000 prize for the organization's STEM program, provided by the National Society of Professional Engineers.

3rd Place is awarded a $2,000 prize for the organization's STEM program, provided by Shell.

Honorable Mention–the 4th and 5th place teams will receive $750 for their organization's STEM program, provided by NCEES.

**A region must have registered a minimum of 20 schools/ organizations by October 31, 2019 to be eligible to send a winning team to the Finals. Note: Winners of a subregion's competition will advance to compete at the Regional Competition. Regional eligibility is determined solely by the Future City Office. Prizes are not transferable or exchangeable. Prizes are subject to the discretion of the awarding organization.*

Finals Special Awards

Unless otherwise noted, these special awards are specific to the Finals held in Washington, DC.
Visit your region's website at www.futurecity.org to see what special awards are available in your region.

Award Name	Award Criteria	Sponsor
Best Age-Friendly City	City that best exemplifies a great place to grow up and grow old. Incorporates age-friendly planning and design throughout city, such as walkable streets, housing and transportation options accessible to people of all ages, and opportunities to participate in community life.	**AARP** AARP is the nation's largest nonprofit, nonpartisan organization dedicated to empowering people 50 and older to choose how they live as they age. With a nationwide presence and nearly 38 million members, AARP strengthens communities and advocates for what matters most to families: health security, financial stability and personal fulfillment. **www.aarp.org**
Best Use of Aerospace Technology in a Future City	Teams should develop a clear statement of the use and benefits of aviation and/or space technology in their projects. Projects can be on, in, or above the earth, in space or on other celestial bodies. Special consideration will be given to aviation and/or space technologies used in the displays.	**American Institute of Aeronautics and Astronautics (AIAA) National Capital Section (NCS)** The AIAA is one of the oldest and largest aerospace-related associations, with the National Capital Section (NCS) being the largest section. The mission of the AIAA National Capital Section is to serve the profession, by acting as a catalyst for information flow and creative exchange. AIAA-NCS supports the educational process that promotes future generations of aviation and space professionals by nurturing interest among students. **www.aiaa.org**
Most Sustainable Food Production System	Design that provides the best sustainable food production system while conserving soil, water, and energy.	**American Society of Agricultural and Biological Engineers (ASABE)** The American Society of Agricultural and Biological Engineers is an educational and scientific organization dedicated to the advancement of engineering applicable to agricultural, food, and biological systems. Founded in 1907 and headquartered in St Joseph, Michigan, ASABE comprises 9,000 members in more than 100 countries. Agricultural, food, and biological engineers develop efficient and environmentally sensitive methods of producing food, fiber, timber, and renewable energy sources for an ever-increasing world population. **www.asabe.org**
Best Use of Renewable Energy	Innovative and efficient use of renewable resources in energy systems.	**American Society of Agricultural and Biological Engineers (ASABE)** The American Society of Agricultural and Biological Engineers is an educational and scientific organization dedicated to the advancement of engineering applicable to agricultural, food, and biological systems. Founded in 1907 and headquartered in St Joseph, Michigan, ASABE comprises 9,000 members in more than 100 countries. Agricultural, food, and biological engineers develop efficient and environmentally sensitive methods of producing food, fiber, timber, and renewable energy sources for an ever-increasing world population. **www.asabe.org**
Most Innovative Design of Infrastructure Systems	Design that accommodates the most innovative systems (e.g., transportation, water and wastewater) for a community.	**American Society of Civil Engineers (ASCE)** Founded in 1852, ASCE represents more than 123,000 civil engineers worldwide, and is America's oldest national engineering society. ASCE advances professional knowledge and improves the practice of civil engineering as the lead professional organization serving civil engineers and those in related disciplines. **www.asce.org**

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Award Name	Award Criteria	Sponsor
Best Integration of Equity in Designing the Built Environment using Nature-Powered Solutions	Teams should show how landscape architects apply design thinking to harness the power of natural resources to solve sustainable development challenges so that all people can live in equitable, environmentally sound, and beautiful environments. Use creativity to apply nature-based solutions to address real-world problems such as gentrification, diversity and inclusion, climate change, air and water pollution, and threats to biodiversity while using fewer resources.	**American Society of Landscape Architects** ASLA is the professional association for landscape architects in the United States and represents more than 15,000 members. The Society's mission is to advance landscape architecture through advocacy, communication, education, and fellowship. Sustainability has been part of ASLA's mission since its founding in 1899 and is an overarching value that informs its programs and operations. ASLA has also been a leader in demonstrating the benefits of green infrastructure and resilient development practices. **www.asla.org** American Society of Landscape Architects
Best Indoor Environment	Indoor environment that encompasses occupant comfort, productivity, energy efficiency, or air quality.	**ASHRAE** ASHRAE is an international organization of 50,000 persons with chapters throughout the world. The Society is organized for the sole purpose of advancing the arts and sciences of heating, ventilation, air conditioning, and refrigeration for the public's benefit. **www.ashrae.org** ASHRAE
Most Sustainable Buildings	In recognition of energy efficient buildings that minimize their impact on the outdoor environment and provide indoor environmental quality for building occupants.	**ASHRAE** ASHRAE is an international organization of 50,000 persons with chapters throughout the world. The Society is organized for the sole purpose of advancing the arts and sciences of heating, ventilation, air conditioning, and refrigeration for the public's benefit. **www.ashrae.org** ASHRAE
Best Futuristic City	Use of futuristic engineering concepts in the city's communications, energy, or transportation systems.	**ASME** Founded in 1880, ASME International is a nonprofit educational and technical organization serving a worldwide membership and sets many industrial and manufacturing standards. **www.asme.org** ASME SETTING THE STANDARD
Best Management of Water Resources	• Efficient design of water treatment and distribution for human consumption, agriculture, industry, recreation, and fire protection. • Responsible sewage collection and treatment for environmental protection and community aesthetics. • Innovative stormwater collection, treatment, reuse and/or discharge back into the environment.	**Bentley Systems, Inc.** Bentley is the global leader dedicated to providing architects, engineers, constructors, and owner-operators with comprehensive software solutions for sustaining infrastructure. Founded in 1984, Bentley has nearly 3,000 colleagues in more than 45 countries, $500 million in annual revenues, and, since 1999, has invested more than $1 billion in research, development, and acquisitions. **www.bentley.com** Bentley *Advancing* Infrastructure
Best Residential Zone	Strategic placement of residential zones that allow maximum return for quality of life issues.	**Chinese Institute of Engineers/USA (CIE-USA)** The Chinese Institute of Engineers–USA is a professional nonprofit and non-political organization founded in 1917 in New York by a group of talented and forward-looking Chinese engineers who graduated from American colleges. Chinese-American engineers in the US have played a significant role in the rapid growth of technology and communications throughout the United States. The total membership is around 10,000 nationwide. **www.cie-usa.org** *Chinese Institute of Engineers - USA*

Award Name	Award Criteria	Sponsor
The City of the Future that Best Incorporates Cultural and Historical Resources	The city whose design best incorporates historical and cultural sites, buildings, infrastructure and customs.	**Cuban-American Association of Civil Engineers, Inc.** The Cuban-American Association of Civil Engineers Inc. is a non-profit corporation whose purpose is to: assist members in maintaining and retaining the highest professional engineering skills; support the highest principles of professional engineering achievements; and advance the engineering profession. **www.c-aace.org**
People's Choice Award	This award is given to the team that is voted by their peers to have the best model. Voting is done by ballot during the Model Showcase.	**DiscoverE** DiscoverE is leading a growing volunteer movement that inspires present and future generations to discover engineering. **www.discoverE.org**
Best City Essay Award	This award is given to the team with the overall highest score as judged by the City Essay Judges.	**DiscoverE** DiscoverE is leading a growing volunteer movement that inspires present and future generations to discover engineering. **www.discoverE.org**
Best Virtual City Design	This award is given to the team with the highest overall score as judged by the Future City judges.	**Electronic Arts Inc.** Electronic Arts Inc. is a leading global interactive entertainment software company. EA develops, publishes, and distributes interactive software worldwide for Internet-connected consoles, personal computers, mobile phones, tablets, and social networks. **www.ea.com**
Most Advanced Smart Grid	Best incorporation of Smart Grid technologies for the safe, efficient and reliable delivery of electricity throughout the city. A Smart Grid is the modernization of the electric power system by applying advanced software tools, computer controls, automation, and two-way communications.	**IEEE-USA** IEEE-USA advances the public good and promotes the careers and public policy interests of more than 215,000 engineers, scientists, and allied professionals who are U.S. members of the IEEE. IEEE-USA is part of IEEE, the world's largest technical professional society with 375,000 members in 160 countries. **www.ieeeusa.org**
Excellence in Systems Integration	Demonstration of excellence in the design of integrated systems of people, material, information equipment, and energy.	**Institute of Industrial and Systems Engineers** Systems world view. Productivity. Efficiency. These are words that describe the distinctive attributes of industrial engineering, and IISE is the world's largest professional society dedicated solely to the support of the industrial engineering profession and individuals involved with improving quality and productivity. **www.iise.org**
Best Transportation System for the Community	Design that best incorporates advanced and futuristic technology in the city's transportation modes. Incorporates strong connectivity among all networks of transportation, even in situations of disruption or emergency. Accounts for safety and coordination among multiple city agencies.	**Institute of Transportation Engineers** Founded in 1930, ITE is an international association of transportation professionals who work to improve mobility and safety for all transportation system users, and help build smart and livable communities. Their network is made up of more than 15,000 members working in over 90 countries around the world. **www.ite.org**

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Award Name	Award Criteria	Sponsor
Best Land Surveying Practices *This special award is presented in all Future City Regions and at Finals.*	The design that employs the best land surveying practices, taking into consideration the high standards used by surveyors to help protect the public's safety and welfare.	**NCEES** NCEES is a national non-profit organization composed of engineering and land surveying licensing boards representing all U.S. states and territories. **www.ncees.org**
Mission Possible: Positively Impacting the Community	This award is given to the team whose Future City design promotes the best overall quality of life and demonstrates the greatest potential to positively impact the community for a sustainable future.	**National Society of Black Engineers (NSBE)** The mission of the National Society of Black Engineers is to increase the number of culturally responsible Black Engineers who excel academically, succeed professionally and positively impact the community. **www.nsbe.org**
Professional Engineering Award	In planning, designing, building, and maintaining your city, please explain and give examples of steps you will undertake to: • Ensure your city's engineers are competent professionals; • Comply with engineering safety codes and technical standards; and • Reject behavior that misleads or deceives the public.	**National Society of Professional Engineers** NSPE is the only engineering society that represents individual engineering professionals and licensed engineers (PEs) across all disciplines by promoting engineering licensure and ethics, enhancing the engineer image, and advocating and protecting PEs' legal rights. **www.nspe.org**
Most Sustainable Environmental Practices	Citizens are educated about sustainability. Citizens actively engage in and promote sustainable environmental practices.	**North American Association for Environmental Education** For more than four decades, NAAEE has promoted excellence in environmental education throughout North America and the world. We are dedicated to strengthening the field of environmental education and increasing the visibility and efficacy of the profession. **www.naaee.org**
Best Future City Project Plan	Teams should be able to explain how they followed the project cycle, including how they created their project schedule, assigned responsibilities, and monitored and controlled their work. Teams should be able to discuss their answers to the Team Reflection questions. Samples of work that highlight teams' project management activities are encouraged.	**Project Management Institute** With nearly 220,000 members in more than 150 countries, Project Management Institute (PMI) is the leading membership association for the project management profession. PMI is actively engaged in advocacy for the profession, setting professional standards, conducting research, and providing access to a wealth of information and resources. **www.pmi.org**
Best City Model	This award is given to the team with the overall highest score as judged during the Model Judging at Finals.	**Shell Oil Company** Shell Oil Company is an affiliate of the Royal Dutch Shell plc, a global group of energy and petrochemical companies with 93,000 employees in more than 90 countries. In the U.S., Shell operates in 50 states and employs nearly 20,000 people working to help tackle the challenges of the new energy future. **www.Shell.us**

Award Name	Award Criteria	Sponsor
Best Application of Fire Protection Engineering Principles in City Design	Fire protection engineers use science and technology to make our communities safe from fire. Fire protection engineering features may include structural fire resistance, detection and notification systems, suppression systems, egress systems, and smoke management systems. The fire protection engineer ensures that these features all work together to protect people, property, and the environment from fire. Design that best incorporates an innovative approach for fire protection, to protect the public, property and environment.	**Society of Fire Protection Engineers** The Society of Fire Protection Engineers was established in 1950 and incorporated as an independent organization in 1971. It is the professional society representing those practicing the field of fire protection engineering. The purpose of the Society is to advance the science and practice of fire protection engineering and its allied fields, to maintain a high ethical standard among its members, and to foster fire protection engineering education. **www.sfpe.org**
Best Use of Innovative Construction Materials and Techniques	Use of innovative construction materials and techniques; overall construction of design.	**Turner** Turner is a North America-based, international construction services company and is a leading builder in diverse market segments. The company has earned recognition for undertaking large, complex projects, fostering innovation, embracing emerging technologies, and making a difference for their clients, employees and community. **www.turnerconstruction.com**
Excellence in Resilience Engineering	Demonstration of excellence in the city design of resilient systems that withstand and quickly adapt to adverse circumstances and events like natural disasters.	**UL** UL solves the safety, security and sustainability challenges of the 21st century. UL tests, inspects, audits, certifies, verifies claims, advises and trains as well as provides software solutions. Around the world, UL employees share a common passion promoting safe working and living environments for all people. **www.UL.com**

Competition Expense Form Instructions

Provide a complete list of all items your team used to construct your model and create your presentation materials. Include actual cost if items were purchased or a reasonable cost estimate if items were donated or recycled. Strive for accuracy and fairness when estimating costs. Misrepresenting the values of your materials will result in a 15-point penalty.

Commonly Asked Questions

1. Why is there a $100 limit?
This rule was established to ensure equity among teams and to encourage students to creatively use recycled materials.

2. When can we assign a zero value?
Items that are allowed in a home or school recycling bin (such as paper, plastic bottles, glass jar, or metal cans) or items bound for the trash (like used up batteries, bottle caps, or used plastic utensils, etc.) can be assigned a zero value.

Download the Competition Expense Form from futurecity.org/resources (filter for Competition Forms & Project Plan).

3. How do we figure out the fair market value?
Items that are donated or have been previously used but can't be recycled (such as mirrors, foam core, dowels, wood, magnets, holiday ornaments, old toys, lab coats, etc.) need to be assigned a fair market value. Fair market or salvaged value may be determined by pricing found at a yard sale, auction, classified ad, surplus store, e-recycling service, etc.

4. What about items we take apart?
Many teams take apart computers, electronics, or other items to 'harvest' interesting parts. These items need to have a value assigned. Scrapmonster.com is an easy place to start.

Examples

Description of City Model Materials	Purchased	Donated	Recycled	Expense/Value
4' x 8' plywood sheet – $20 (but only used half)	•			$10.00
Assorted paint from parent's garage		•		$2.00
Two one-liter soda/pop bottles			•	$0.00
Egg carton			•	$0.00
Toy train		•		$0.50
Motherboard from scrapped computer			•	$2.50
Green LED lights	•			$4.50
			Subtotal A—City Model Expenses:	$19.50

Description of City Presentation/Special Award Materials	Purchased	Donated	Recycled	Expense/Value
Foam poster board	•			$9.00
5 pages of color printing	•			$5.00
Top hat (Costumes)		•		$3.00
Lab coat (borrowed from teacher)		•		$2.00
			Subtotal B—City Presentation/Special Award Materials Expenses:	$19.00

Subtotal A $19.50 + Subtotal B $19.00 = Total Expenses $38.50

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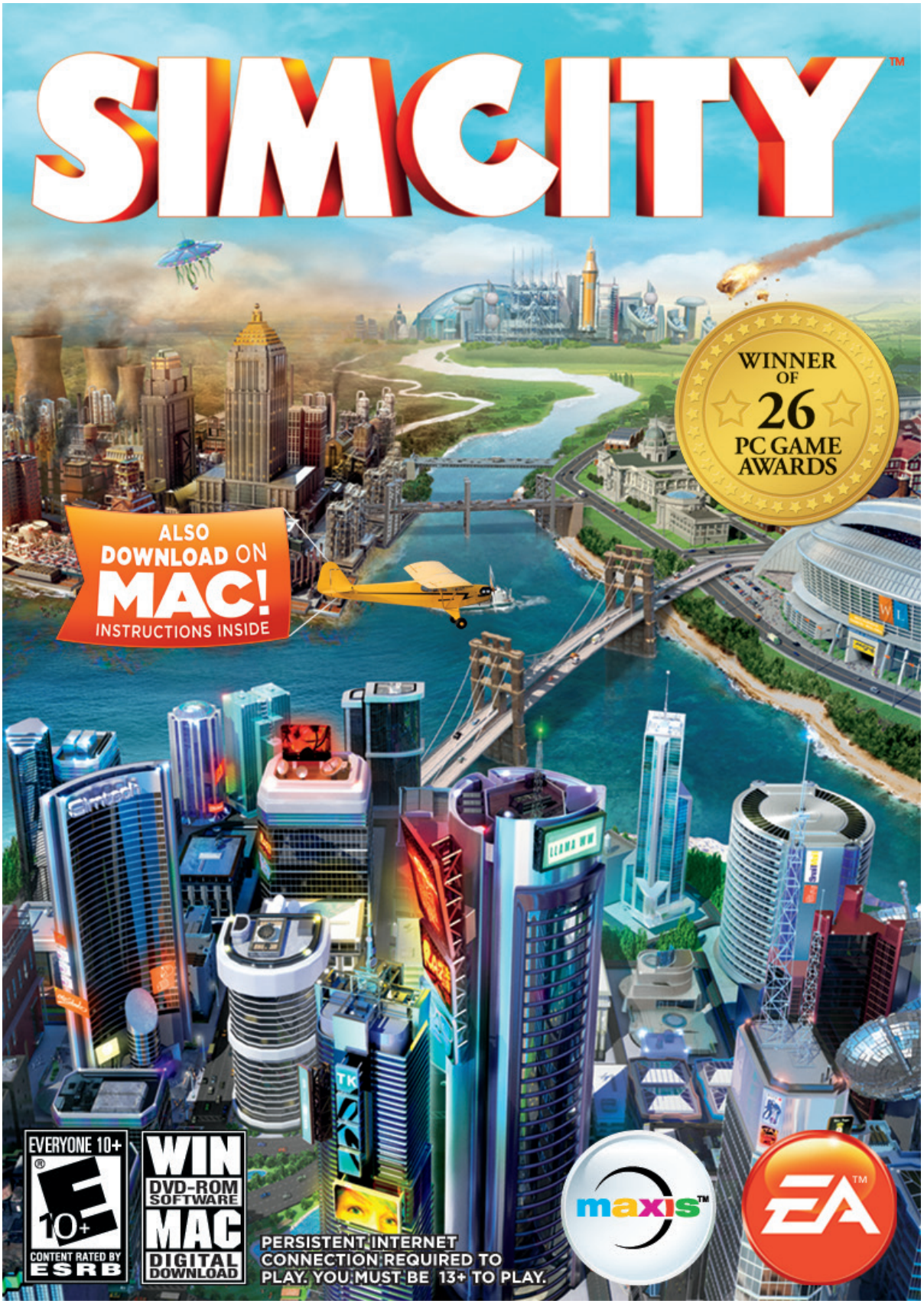
Regional Coordinators

The Future City staff would like to thank and acknowledge the dedication of our tireless Regional Coordinators and their committee members. The countless hours that they contribute as they answer every question (big and small), match mentors to schools, fundraise, and host wonderful Regional Competitions is the foundation on which Future City rests. Thank you!

ONLINE

To contact your Regional Coordinator, visit www.futurecity.org and click on Find My Region.



We would like to thank our generous sponsors for their continued support of the Future City program.

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Future City is a program of DiscoverE.